October 1959

Agriculture

Volume LXVI Number 7

Over the gate

Published for the Ministry of Agriculture, Fisheries and Food
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NUFFIELD FIELDMAN REPORTS . . .

Travelling from farm to farm I've heard nothing but praise for Nuffield reliability. "The B.M.C. Diesel is the best tractor engine made" said one farmer. And echoing his words, others lauded the first-time starting and easy maintenance. It was widely agreed that the Nuffield 'Three' does more work per hour and therefore saves both time and money.

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Work Study in Relation to Farm Management

ARTHUR JONES, M.A., B.SC., B.LITT.

Chief Farm Management Adviser, National Agricultural Advisory Service

At the National Farm Management and Work Study Conference, held on Mr. Peter Smith's "Bradshaws" Farm, at Oaken, Wolverhampton on 2nd July, Mr. Arthur Jones stressed that work study is an integral part of management seen as a whole—a single facet of full assessment.

WORK study and farm management are both extremely important subjects of which farmers should make full use if they and the farm workers—and indeed the country as a whole—are to reap the maximum economic and social rewards. Broadly speaking, farm management is concerned with the three traditional factors of production—land, labour and capital—and its function is the allocation of scarce resources between competing needs. Work study, on the other hand, is concerned by and large with *one* factor of production only—labour.

It is the job of farm management to get the highest profitability by obtaining the best possible combination of all resources. The farm management adviser, or the farmer himself, analyses the farm business in much the same way as the work study specialist goes about his work. He studies the present situation with the aid of the farm accounts and records; he examines it for its strength and weaknesses, which he judges partly from his own experience and also from a reference to the performance of other similar farms which may help him to take a short cut to the crux of the problem. However, it is not merely one activity that is being studied, but every enterprise on the farm, to see if it is really pulling its weight and making its full contribution to the profits of the farm.

The next stage in a farm management investigation is, as in work study, to develop the improvements which have been suggested by the examination of the business. Here farm management has the well-known technique of budgeting to enable a choice to be made between different possible combinations of resources. Every farmer will have ideas about what form this redistribution should take according to his experience and his inclinations. It is the job for the farmer or his adviser to show what the alternatives mean in costs and returns. By preparing a budget, he will be able to say whether five extra cows are likely to boost his income more than eight acres of wheat, or whether neither of these alternatives is likely to be as profitable as adding to his sheep flock. This budgeting technique can be applied both to a reorganization of the whole farm or to a relatively small change such as whether or not to buy a combine harvester. *Farm management is concerned with the best organization and combination of all the resources on the farm for the achievement of a given end, be it maximum profitability or a quiet life. Work study is the micro-science concerned with the organization of resources in the carrying out of a particular operation or activity.*

Individual and national gain

Do let us be quite sure that all the effort being put into work study and management is used to the best advantage. I know of quite a few cases where work study has been misused because basically what the farm required was an economic analysis and a planned shift of farming policy. To many farmers, dissatisfied with parts or indeed perhaps the whole of their farming affairs, work study seems a relatively straightforward business to apply. A small reduction of costs brought about by work study might appear more attractive than facing up to unpalatable home-truths and subsequent radical alteration of farm policy. But so often work study can prove only a palliative. And *ad hoc* applications without a management background may often merely postpone the day of reckoning.

The clear object of applying farm management and work study techniques is to improve productivity on the individual farm—to improve, in fact, the income of the farmer and to bring about nationally a better use of resources. I mention the national picture deliberately, for while we in the N.A.A.S. advise an individual wholly on the basis of the individual's circumstances and requirements, our prosperity in the long run clearly rests on how the country as a whole is doing.

Life for all of us today is becoming more and more complex. It is difficult to resist the suggestion that the days of the general practitioner are numbered, whether in agriculture, medicine, or a whole host of fields where technological progress is so rapid. One of the ways in which we can ease complexity is by examining our farming systems to see whether or not we can reduce our commitments as far as lines of production are concerned, and intensify production through a smaller number. It seems to me quite clear that the future must lie with the man who has made himself really expert at producing two or three things, rather than the man who does too many and none of them really well.

We have heard much about simple farming systems in the last couple of years, but the undoubted lesson of much that has been said has only got home in one or two quarters. Far too many farmers still tend to overload their managerial and technical ability to their financial loss. I am aware of very many farm management cases handled by the N.A.A.S., where spectacular increases in profitability have been achieved by streamlining systems —by reducing the number of farm departments and then intensifying production in those that remain. If I can put it in the broadest outline, it is the job of farm management to analyse the business, to reveal weaknesses and very often to simplify the system in the light of the analysis made; and then to bring in work study to streamline a particular job or process and thus further increase productivity.

The example of the Bradshaws

Mr. Peter Smith's Bradshaws farm furnishes a good example.* The highlight of this 400-acre farm is the tremendous increase in output by

* The enterprise is briefly described on pp. 270–1.

simplification and intensification of production on fewer enterprises. The system has been reduced from fifteen enterprises in 1950–51 to five in 1958–59. The expansion of the business is illustrated by the following short table:

	Before change	
	£	
Gross output	34,000	(£85 per acre)
Labour	8,500	(£21 per acre)
	After change	
	£	
Gross output	60,000	(£150 per acre)
Labour	12,000	(£30 per acre)

Manchester University Survey
High profit farms

Gross output	£83·8 per acre
Labour	£18·8 per acre

It will be noted that the gross output per acre is almost double what is regarded as a high profit farm in this category by Manchester University, and that the labour per acre is considerably higher. The introduction of intensive management on the five enterprises has allowed a substantial expansion of output, and *work study* has allowed more time and energy to be devoted to the systematic planning of the work.

Bradshaws also illustrates the high degree of management and the very high output which can be achieved with a relatively low amount of capital in machinery operating costs.

In 1953 the capital invested in machinery amounted to approximately £9,000. In 1958–59 the capital invested was £6,000 or £15 per acre.

Mr. Smith has reduced the number of his enterprises from fifteen to five and yet he has practically doubled his gross output and, I should have thought, his profits. This is a magnificent achievement and I hope I shall not offend any of my other work study friends if I point out that this result is largely due to reorganization and simplification, which is the field of farm management. After all, Mr. Smith and work study experts could have spent a great deal of time studying the labour routines used in the original system and, no doubt, making improvements, but certainly without the effective and spectacular results achieved by reorganizing and simplying the whole farm business. For example, any time saved in the reorganization of the poultry enterprise would have been unimportant and wasted since it was decided to dispense with this and a number of other enterprises altogether. On the other hand, the knowledge that reorganization on this scale was possible with the existing labour force was due to obtaining, from work study experience, information about efficient methods of doing particular tasks.

Farm management and work study are indivisible

To sum up, there is no question whatsoever that work study can contribute a great deal to increasing the productivity of British agriculture, but it must not be looked on as a short cut to success. Generally speaking, I feel that there would be considerably less wastage of the valuable time of work study officers if a farm management analysis had preceded detailed work study, so

that the time of the work study specialist could be devoted to the streamlining of key operations. Farm management and work study are partners and complementary to each other; there is nothing to be gained by confusing them.

Fewer Enterprises: Greater Profit

A summary of MR. PETER SMITH'S account of how the management of his farming has been simplified by work study.

THE first point I particularly wish to make is that the type of farming being done here at the Bradshaws is not necessarily the type of farming everyone should do. Obviously, we cannot all grow black currants and turkeys, any more than we can all grow wheat and beef. What we are trying to show is the need for adapting a farming system to suit your own particular farm, and to make certain that this system is sound economically and can be worked on a sound rotation.

For there is little doubt that conditions are going to become more competitive, and that we have to cheapen our production costs still further. I feel that the basis of our farming problems is to run the farm profitably and with the minimum of effort, because a system that is run easily is usually run more efficiently. I am quite sure that the last thing we would wish to suggest is that the farming here is any better than, or even as good as, the farming in the district.

I have been fortunate in having the benefit of the help of the I.C.I.'s Agricultural Work Study Team, which I realize is not generally available. The work study of the individual farmer applied to his individual problems is quite an expensive business, but the standards that are being arrived at by work study are going to be of immense benefit to anyone who is prepared to interpret and fit them into his own farming picture. My main reaction to work study has been the impact it has had on my outlook, and I feel that any farmer who is able to get even one small section of his enterprises work studied would so completely alter his outlook on his farm that the benefits would be far reaching.

We are in the middle of carrying out the work study recommendations and the simplification of the farm cropping. So some of our programme is still not yet completed, since it has been a very big task in so short a period to carry on with the old and implement the new—and one has to be very strong-willed to knock down one's mistakes.

On the Bradshaws we are engaged on five main products. The arable part of the farm is in five blocks, in five-course rotation, consisting of three years in grass and two years in wheat. We have, I think, arrived at the stage where we should be able to get the whole of the cereal acreage in with winter wheat, as we have no busy period at that time of the year.

It is all one variety, Capelle, combine drilled in the autumn, top dressed with nitrogen in the spring, depending on how it looks and what the weather

conditions are. Until now, all the leys have been undersown, but I am coming round to the view that we should direct seed. It is becoming increasingly difficult to grow heavy crops of wheat and at the same time establish a good take of grass seeds. They are being grazed exclusively by beef heifers for the production of single-suckled store calves. They are now (June) in calf for November/December, and having calved outside, will be brought in on to self-fed silage, with their calves at foot. I think we should be able to keep a cow and its calf on about 1¾ acres, including growing the grass for making the silage for their winter keep, and we are aiming at producing beef calves entirely off grass with no supplementary feed whatsoever.

Our silage for self-feeding was mown off 110 acres of grassland by a team of two tractors, two men, one forage harvester, one trailer and one buck-rake. We arrived at the method and machinery to be used by the use of the I.C.I. *Work Study Guide to Silage-making*. We think that we have about 675 tons of settled silage, and it was put there by this team in two consecutive weeks, at a labour cost of 2*s*. per ton. Straw will be stored on top of it for bedding the cattle and pigs.

The centre block of black currants is rather a specialized crop, and until now has been the most expensive part of the farm programme to establish. The water towers are placed in strategic positions for spraying, and some of the bushes are mulched with straw. With the recent wet harvest, we have not been able to get straw at an economical price to mulch them all, but if the opportunity arises we shall do so. We are now satisfied that complete weed control is possible with automatic spraying, and we shall use dalapon and MCPB throughout the plantation this autumn.

The buildings which house the turkey and pig units are pretty old and have been adapted for their present use after intensive work study investigation. The pig unit is not yet at full strength. We are only just getting back into full production after establishing a virus-free herd last February. All the meal that is used is ground and mixed on the farm, with the exception of the starter ration for the day-old turkeys. No offals are used—only whole grain being ground.

These five products give us five well-spaced labour peaks and should give us plenty of time for our routine work in between. All the machinery used on the farm has been kept simple and to an absolute minimum, and at the same time is adequate for our present cropping programme.

In conclusion, I should like to thank the National Agricultural Advisory Service, the National Farmers' Union and the I.C.I. for the help and advice they have given to enable me to simplify my farming system. I would like to add a special word of thanks to the farm staff for their co-operation in putting into practice the new approach to our problems.

The Veterinary School, University of Bristol

PROFESSOR C. S. G. GRUNSELL, PH.D., M.R.C.V.S.

Department of Veterinary Medicine, University of Bristol

Prof. Grunsell shows how the school has progressed from its inauguration in 1948 to the present day, the major items of work on which it is engaged, and its future aims.

THE year 1844 will always be regarded by those interested in veterinary education as a date to remember, for a Royal Charter was then granted to graduates of the two Veterinary Schools of the time—in London and Edinburgh. Exactly one hundred years later the Loveday Committee published its second report on veterinary education. The recommendations of this Committee were largely accepted and formed the basis of the Veterinary Surgeons Act of 1948. Under this Act the holders of veterinary degrees of certain universities can claim admission to the Register of Veterinary Surgeons, provided the degree is recognized by an Order of the Privy Council after consultation with the Council of the Royal College of Veterinary Surgeons. This was a most important step forward for veterinary education, as it meant that the existing schools became integral parts of adjacent universities; furthermore there was provision for the establishment of two new schools, one at Cambridge and the other at Bristol.

In selecting the parent universities for these new schools certain conditions had to be fulfilled. They had to be sufficiently remote from the existing schools; there must be suitable accommodation within the universities for the pre-clinical years; and it was essential that a field station could be established within easy reach of the university chosen. Finally it seemed highly desirable that one of these new schools should be in close touch with the large and important grazing districts in the south-west and west. After due consideration it was decided that the university most nearly satisfying these conditions appeared to be Bristol, and accordingly in 1948 a veterinary school was inaugurated by the Rt. Hon. Tom Williams, then Minister of Agriculture.

Close links with university

In their report, the Loveday Committee had emphasized the great advantages that would accrue, to both staff and students, from the closest possible relationship between the various disciplines represented in the veterinary course and the respective university departments. It was with this recommendation in mind that the new Veterinary School at Bristol was established within the Faculty of Medicine. Thus the departments engaged in teaching the basic sciences in the medical curriculum are now jointly responsible for the pre-clinical section of the veterinary course.

The first students to embark on the new course entered the University in 1949, and facilities provided by the Departments of Zoology, Botany, Physics and Chemistry were completely adequate to provide for this year devoted to the fundamental sciences. Thereafter, however, in the pre-clinical part of the course we find that varying degrees of modification and extension have been necessary to meet the special needs of the veterinary students. Thus in the Department of Physiology it was necessary to appoint new staff with veterinary qualifications or experience so that, after the sections of the course taken together with medical students, the veterinary undergraduates could separate for special emphasis to be given, for example, to the physiology of reproduction and lactation in farm animals and to the physiology and biochemistry of ruminant digestion.

At about this stage in the course the student is introduced to the science dealing with the action of drugs and therapeutic substances upon the animal body. This is taught within the Pharmacology Department of the University, but again some increase in the staff of that Department has been needed to meet the special requirements of the veterinary student. In the case of veterinary anatomy, however, it was found necessary to create a separate and autonomous unit within the existing Anatomy Department, and furthermore to provide a building for it. This building, which was in fact the first tangible expression of the new Veterinary School at Bristol, was completed in Park Row in 1950, and provides accommodation for teaching and research for both the Anatomy Department and for the veterinary section of the Physiology Department.

Animal health

The importance of a proper understanding of the methods by which farm animals are kept in maximum health and production has been fully realized, and the subject of animal husbandry is taught throughout the *second*, *third* and *fourth* years. It is regarded as an extension of physiology, and covers animal management, nutrition and housing, breeding and genetics. It is perhaps of interest that a period of vacation farm work is a statutory requirement for the veterinary student at Bristol University. Animal husbandry forms a bridge between the pre-clinical and clinical parts of the course, and merges into the subjects taught later. The object of the course is not only to familiarize the veterinary undergraduate with methods of stock husbandry, but also to show the relationship of the different techniques of stock-raising and production to the incidence of disease in its various forms.

The study of the animal body in disease is begun in the Department of Pathology in Bristol, and covers the basic aspects of the subject common to both human and veterinary medicine. At the same time, and in the Department of Bacteriology, the student is studying the nature of the organisms which invade the animal and cause the so-called infectious diseases, of bacterial or viral origin, while in the Zoology department he is hearing about the morphological characters and the life cycles of the various parasites, worms and mites which attack the domestic animal. In the first four years of the course, classes are taken out to farms from time to time in the animal husbandry course, but in the main the teaching is carried out either at the Veterinary School in Bristol or in the appropriate University department.

Field station for training in final year

The teaching of the clinical subjects in a veterinary curriculum presents special problems, arising from the fact that it is generally not feasible to provide hospital accommodation for farm animals within the precincts of a university, nor are farms likely to be of easy access. Recognizing this difficulty, the Loveday Committee on Veterinary Education laid great emphasis on the need for the establishment of field stations in all veterinary schools. Thus in 1951 Bristol University bought the freehold of Langford House from the Commissioner of Crown Lands. The village of Langford is some thirteen miles from the University, on the Bridgwater side of Bristol and in the centre of good stock-farming land. The house has been adapted to provide a library, dining and common rooms.

It was realized, however, during the planning of the final year course, that it was essential for the students to have ready and continuous access to both medical and surgical cases in the hospital. It was therefore necessary to arrange for the entire group to live on the estate. Provision for this has been made by the building of a hostel near the main house, giving each member of the final year a study-bedroom. The design of the hostel has proved itself to be well suited to our needs, and has been studied by a number of visitors from other veterinary schools planning similar accommodation for final year students.

There is close liaison between the different members of the staff in both teaching and research, but for administrative purposes it has been found necessary to make a division into two sections. These are medicine and animal husbandry on the one hand and surgery on the other. The first buildings to be completed were mainly lecture rooms and practical classrooms for teaching, and research laboratories for the medicine and animal husbandry staffs. Much of this was accomplished by the ingenious adaptation of existing farm buildings and outhouses; and within the four walls of what was once the coachhouse, a conference room and a museum were constructed to serve the field station as a whole. This Medicine Wing, as it is called, has been in use since July 1952, when it was officially opened by the Rt. Hon. Sir Thomas Dugdale, then Minister of Agriculture.

In the subsequent five or six years, more accommodation was built, mainly for farm animals under experiment. In July of last year, however, a further important step was taken towards the completion of the school at Langford when a Surgery Wing was opened by the Chairman of the Council of the University, Sir Wilfrid Anson. This new building provides operating theatres for all classes of farm stock, together with ancillary facilities which include a specially constructed X-ray room.

School farm

It also became evident that if research projects, including the use of farm livestock, were to be kept supplied with animals of a constant standard of health and breeding, the school would need a small farm on which all classes of stock could be raised. In this connection the University was fortunate to be able in 1956 to buy a holding of approximately 136 acres in Langford, and adjacent to the School. In addition to supplying animals for experiment

the farm is also used to demonstrate some of the more intensive systems of husbandry, and provide the necessary animals for the teaching of animal management and control.

Keeping in touch with agriculture

In all veterinary schools there is an ever-present danger that both teaching and research will become divorced from current disease problems and husbandry developments. With this in mind, those responsible for the early planning of the Bristol School arranged for the Veterinary Investigation Laboratory of the Ministry of Agriculture and the Somerset Cattle Breeding Centre to be sited on the estate. The presence of these organizations, although outside the University's jurisdiction, is a considerable help in counteracting the tendency of the school to lose touch with conditions in the field. The Veterinary Investigation Laboratory provides a diagnostic service and undertakes field investigations into outbreaks of disease among all classes of farm stock within the counties of Somerset, Wiltshire, Gloucester and Dorset, and students have access to the interesting material coming into the Laboratory for examination. The staffs of the Investigation Laboratory and of the Cattle Breeding Centre are recognized teachers in the University, and contribute to the teaching of undergraduates in the final year.

The virtual disappearance of the horse as a farm animal, the improvement in all classes of other farm stock and the development of more and more intensive methods of husbandry have necessitated great changes in veterinary teaching over the last twenty-five years. Being a new school, Bristol was fortunate in being able to plan its course to suit the needs of the modern veterinary general practice. For example, because of the high value attaching to individual farm stock, many surgical operations have become a completely economic proposition. During the year ending May 1959 over 700 major operations were performed on farm stock at Langford. Students participate in these surgical operations, including the induction of anaesthesia, and are responsible for the post-operative care of patients.

Preventive medicine

In recent years almost everyone writing on the veterinary curriculum has stressed the importance of preventive medicine in farm practice today, and at the Bristol School as in the other veterinary schools in the United Kingdom a large section of the course in medicine is devoted to describing methods of disease control and eradication. Stress is laid on the need for a very sound knowledge of the current practices and trends in feeding, housing and management, and an appreciation of the impact that the more intensive methods of husbandry are having now, and will have on disease incidence in the future.

The importance of looking forward in the training of students is recognized, and attempts are made to equip graduates of the school for any new spheres of responsibility they are likely to meet in the field of animal health. Thus, for example, although at present the general practitioner plays a relatively small part in the control and prevention of diseases of poultry, it is realized that with the growth of the industry there will be scope for a greater

contribution from the profession, and therefore this subject occupies a considerable part of the course. Much the same may be said of meat inspection, and at Bristol a separate professional examination is held which covers also the state controlled diseases and the diseases transmissible to man.

It would probably be true to say that with the coming of specific laboratory diagnostic tests and of antibiotic therapy, there is a real danger, in both the medical and veterinary professions, that the art of clinical diagnosis may largely be lost. Efforts are therefore made to develop in the student the art of careful clinical observation, both in the interests of accurate diagnosis and because it is believed that in the case of "new" disease conditions and entities there is a need for clear descriptions of the clinical findings and the circumstances under which the diseases are occurring. Without these accurate reports, much of the relevance of the findings of the research worker may be missed.

Research

The research interests of the staff of the animal husbandry and veterinary medicine sections are at present mainly turned towards the breeding, nutrition and diseases of farm livestock. During the past five years the various factors influencing fertility in cattle, including the whole subject of breed improvement, have been closely studied; and more recently attention has been directed to the technique of artificial insemination in the pig. In the field of nutrition, workers at Langford have made a unique contribution by elaborating a method for the artificial rearing of baby pigs. This technique is now being used to study the blood chemistry in early life. An interest in the field of animal viruses was started by the late Professor Blakemore, and at the time of his death important work was in progress on the respiratory viruses of the pig. Experimental transmission and tissue culture methods are now being used to investigate certain poultry diseases of major importance which are claimed to be viral in origin.

Research work in the Department of Veterinary Surgery has primarily been directed towards the improvement of techniques in the abdominal surgery of farm animals, with special emphasis on obstetrical operations. Work on anaesthesia of horses, together with experimental surgery in connection with the study of "luteal" activity in this species, has been carried out with encouraging results. In this department during the last four years, members of the Bristol Royal Infirmary staff have performed cardiac surgery on goats which has been beneficial and stimulating to the veterinary staff.

The British Seeds Industry

HENRY BURTT
Chairman, British Seeds Council

Our seeds are good and improving all the time, but we must redouble our efforts to promote sales. A certification trade mark for herbage seeds, introduced in September 1956, is a symbol of consistent high quality.

SEEDS have been described as the raw material of agriculture, and over the years it has been the aim of all those engaged in the British seeds industry to breed, produce and sell the finest in the world. By putting the best into the land, the farmer can be sure of getting the best out of it. Without doubt, our research workers and plant breeders have bred many of the best varieties of plants, and as an industry we must take full advantage of their valuable work to ensure that British seeds take their rightful place in the national and world economy. British agriculture must surely supply an increasing proportion of the nation's food at competitive prices, while not only maintaining but enhancing soil fertility without undermining the structure of this country's greatest asset, the land itself.

To what extent can the seeds industry claim to be fulfilling this vital responsibility towards British and world agriculture? Has it accepted the challenge of leadership, or has it failed? A glance at crop production should provide the answer.

Better seeds: better crops

A substantial part of the increase of over 60 per cent above pre-war agricultural output is due to better seeds. The National Institute of Agricultural Botany's motto "Better seeds: better crops" has undoubtedly paid good dividends. The output of our most important crop, which is grass, is the most difficult to measure; nevertheless it is generally conceded that as a result of a quarter of a century of intensive work by the plant breeder the farmer can now buy seeds which enable him to keep more livestock. Many shrewd farmers and graziers claim an increase in grass output of 50 per cent —surely a notable contribution to the total output of livestock and livestock products from British farms, which is now worth more than £800 million a year.

Long-term arable farming at maximum output can be maintained only by a sound rotation of crops, and it is here that the higher productivity of the British-bred varieties of grass plays its most important part for the farmer and the nation as a whole. In consequence, that part of the British seeds

industry which deals with herbage seeds has assumed a new role of national importance.

Equally rewarding results are available for other crops. Yields per acre of wheat and barley have increased by no less than 44 per cent, mainly because better varieties are readily available. New varieties of oats have accounted for an increased yield per acre of over 20 per cent, a further indication of the sustained work of the plant breeder. How many of us remember that not so very long ago our only winter oat was Old Grey Winter, with its attendant nightmare of harvesting lodged corn?

One of the real highlights of the seeds industry has been the development of new varieties of sugar beet. These new seeds have increased yield per acre by 35 per cent; a larger acreage is being grown economically, and our production of sugar beet has increased from two-and-three-quarter million tons to over four-and-a-half million.

Pages could be written of all the selfless work and effort that have been given by plant breeders and research workers. Better varieties of potatoes, root vegetables and flowers are further evidence. Not only has the breeder to evolve higher-yielding plants, but also to aim at producing varieties that are more resistant to disease. The vast British horticultural industry, with an output of almost £150 million worth of produce, requires new and finer varieties of seed to meet the consumer's demand for better produce: and to enable him the better to fight foreign competition. Work on the production of seeds of new and more beautiful flowers has encouraged millions of householders to spend their leisure hours creating their own flower-gardens, giving delight to all. I wish every city dweller knew the delights of a cottage garden.

Our seeds industry is a very complicated structure. The plant breeder is helped by the National Institute of Agricultural Botany, with its field approval schemes and trials of varieties, its valued recommendations on productivity and The Official Seed Testing Station for England and Wales. The National Certifying Authority for Herbage Seeds and the N.A.A.S. also play a valuable part and so, of course, do the growers and merchants who make the plant breeder's products available to the farmer. These interests are not arranged in any order of importance: indeed, it would be impossible to give one priority over another. The failure of any one could easily weaken the whole edifice.

There is no question, therefore, that the seeds industry is playing a literally vital role in modern British agriculture. Its value to the national economy can hardly be disputed, since we are now producing half the food needed by our population of 51½ millions, and so making a valuable contribution to our balance of payments.

Selling the goods; a certification trade mark

The seeds industry accepts the challenge of leadership in the rapidly changing techniques of modern commerce. We have the finest material in the world, the right kind of people and the enthusiasm to succeed. The present serious competition from abroad should not deter us; it is the stimulus that every industry needs to spur it on to greater efforts. The industry does not fear healthy competition.

For quality and productivity our seeds can compete in the world markets, but we must convince the consumer of this, and redouble our efforts to promote sales. In the past, the industry may not have paid enough attention to modern methods of sales promotion. A product may be good but this in itself does not sell it—it must be *known* to be good; the consumer must be in no doubt as to the value of the product he is buying. Perhaps even more important, he must be assured that the article can continue to be produced at the standard of quality he has been taught to expect.

The seeds industry, with the strong support of its herbage section, took a very definite step in this direction when it introduced the National Comprehensive Certification Scheme, which now embraces 100 per cent of the total production of Aberystwyth varieties. Under this scheme the National Certifying Authority issue a certificate, coupled with the use of the certification trade mark, which is becoming widely recognized the world over as the hallmark of quality and reliability.

If the seeds industry has lagged behind commerce in the promotion of sales by the use of a brand, or perhaps particular packaging with its attendant economies, then the availability of such a hallmark may stimulate future development.

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Raspberry Research

C. A. WOOD, B.SC., PH.D., M.I.BIOL.

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Dr. Wood shows how modern commercial raspberry production, faced with changing market requirements, is benefiting from complementary lines of research in plant breeding, plant pathology and crop husbandry.

RASPBERRIES in England and Wales occupied slightly less than 2,500 acres in 1958, about one-third of which were in Kent and the rest mainly in the counties of Norfolk, Worcester, Hereford and East Sussex. By contrast, the area under raspberries in Scotland exceeded 8,000 acres. Of these some 7,300 were almost equally divided between the adjoining counties of Perth and Angus, and a further 300 were in Fife. Several causes have led to this distribution of the industry, one, no doubt, being the general tendency of the raspberry to do well in northerly parts of Britain. In east-central Scotland, and particularly in Strathmore, favourable conditions of soil and climate and the growth of wholesale markets have encouraged a gradual expansion of the industry since it first began there towards the end of the last century.

Research at present makes its impact upon raspberry growing from three main directions: by the breeding of new and better varieties; in the application of the results of virus research to the production of disease-free nursery stocks; and by the investigation of problems in the cultivation and management of fruiting plantations. These lines of work are interrelated and complementary.

Breeding

Most raspberry varieties of the past were seedlings of chance origin, selected for their merits but of unknown or uncertain parentage. In this category are Lloyd George, Norfolk Giant and the Lanarkshire variety Burnetholm Seedling, varieties which are still grown commercially today after forty or more years' existence. Purposeful raspberry breeding in Britain began with the work of N. H. Grubb at East Malling in the nineteen-twenties and thirties, which resulted in the raising of a series of varieties, four of which—Malling Promise, Malling Jewel, Malling Exploit and Malling Enterprise—have established a place in commerce since the war. Of these, Malling Promise and Malling Jewel have been the most generally outstanding. Grubb increased the productive capacity of raspberries by breeding particularly for large fruit size, and the cropping performance of his varieties has been maintained by means of the improved methods of virus disease control developed in recent years. It is possible that raspberry yields will be raised still further in the future, partly by breeding for the elimination of such faults as susceptibility to winter frost injury, failure of the buds on the lower parts of canes and structural weaknesses in fruiting laterals: but perhaps more important now than yield is fruit quality, especially firmness of texture. The expansion of the canning, quick freezing and fresh fruit trades is placing an increasing premium on varieties with fruit that can be transported and processed without loss of shape or structure, and which are of high quality in colour and flavour. In the jam trade, too, increasing emphasis is being placed on setting quality, and on characters affecting the appearance of the seeds in the preserve. It is one of the tasks of the breeder to combine these features of fruit quality, with high yielding capacity.

In addition there are the problems of disease, particularly of virus infection, and here the lines of approach open to the raspberry breeder trying to breed for resistance have been made much clearer by recent research. Several workers, most recently Hill,[1] have shown that varieties differ in the readiness with which they are accepted as host plants by the aphid *Amphorophora rubi* (Kltb.), the principal vector of raspberry viruses, and the genetical basis of these differences has been studied by Knight and his co-workers.[2] Direct resistance to infection by aphid-borne viruses, as distinct from resistance to colonization by their insect vectors, is also to be found among raspberry varieties.[3] Immunity to each of the three soil-borne viruses known to infect raspberries can be found among varieties and seedlings grown in commerce,[4] and an attempt to combine these immunities is in progress at Mylnefield. Raspberry varieties also differ in their susceptibility to fungal diseases of the canes and fruit, important among which are cane spot (*Elsinoë veneta*) and grey mould (*Botrytis cinerea*). These, too, must be taken into account by the breeder.

Future breeding within the true raspberry species is therefore likely to be concentrated on the improvement of fruit quality and disease resistance, in both of which the high yielding varieties of today are deficient. In a wider context, the genus *Rubus* offers unexplored possibilities of breeding new hybrid fruits like the loganberry and veitchberry, both of which are thought to have arisen by the intercrossing of raspberries with related species. Know-

ledge now available of the origin of these hybrids should enable a purposeful approach to be made to the breeding of still better types.

Production of healthy nursery stocks

For as long as virus-susceptible raspberries are grown, the production of healthy planting stocks for sale to fruit growers will remain a necessary and largely independent task, making considerable technical demands on organizations responsible for virus testing and stock inspection. During 1948–1957 the *élite* raspberry stocks issued from Dundee were of a status called "virus tested", and were the healthiest that could be obtained by visual inspection augmented by graft testing. Those of Malling Promise, Malling Exploit, Lloyd George and Norfolk Giant carried viruses of only a very mild type, whilst those of Malling Jewel and Malling Enterprise, although vigorous, were more seriously infected, and were never eligible for certification at "special stock" level. All these stocks are now being replaced by completely virus-free material produced by heat therapy, and first released from Mylnefield in 1958.

The two-year propagation cycle applied to the new stocks at Mylnefield starts in spring with the multiplication of individual virus-free plants by the intensive root and stem-cutting methods of Hudson,[5] which give a rapid build-up of young plants rooted in pots under glass. These are transplanted into the field in April or May to establish cane nurseries,[6] which are treated with systemic insecticides for aphid control during their two seasons of growth. The canes harvested in the second autumn are at present supplied mainly to "special stock" propagators in Scotland and to the Nuclear Stock Association in England and Wales.

The work so far outlined was designed to eliminate viruses spread by aphids. Soil-borne viruses pose an entirely different problem, to which a more immediate solution from the plant breeder may be required. It has not yet been clearly established that these viruses can be eliminated from plants by heat therapy, but existing foundation stocks of raspberry fortunately appear to be free from them.

Performance trials are clearly not needed to establish the superiority of healthy raspberry stocks over degenerate material, but it is important to know how the stocks which have been obtained by heat therapy compare with those previously regarded as best. The present evidence is that they are superior. A replicated trial to compare the new and old stocks of Malling Jewel and Lloyd George was planted at Mylnefield in spring 1957, and on the combined 1957 and 1958 crops the virus-free stocks out-yielded the older stocks by 39 and 13 per cent in the two varieties respectively.

Management of fruiting plantations

Having planted healthy stock of a chosen variety, a grower can improve his prospects further only by cultivations which promote the highest efficiency in performance of the fruiting plantation. It is for this reason that the more important cultural factors in raspberry growing are being systematically studied at Mylnefield, firstly to determine their effects on plant and plantation performance and later, where necessary, to assess their value in

relation to their cost. Many cultural methods and practices can be and are varied at the grower's discretion, and most can readily be studied experimentally. A typical case clearly involving both effect and cost is the alternative of planting canes singly at each site or of planting them in twos ("double" planting). The latter is an old practice, doubtless much adopted when growers were persevering with stocks of inferior vigour. An experiment with healthy stocks of four varieties, however, has shown that double planting can increase yields in the first two or three cropping seasons to an extent easily sufficient, at the cane and fruit values of recent years, to cover the cost of the extra canes planted.

Studies on planting distances have shown that if raspberries are planted at wide spacings, especially between the rows, fruit yields per unit area fall rapidly. Any increase of inter-row spacing beyond 5½ feet, or of inter-stool spacing along the rows beyond 2 feet, has been found to reduce yield, because although individual plants grow and produce better when given more space, this does not compensate for the loss in plant and cane populations per unit area. For normal terrain and the machinery now popular, a distance of 6 feet between rows seems ideal. Stool spacings within rows should probably never exceed 27 inches, and 24 inches should suffice for Malling Jewel, Malling Enterprise and other varieties which are "shy" in cane production.

Methods of training and supporting raspberries are a frequent topic of interest, and here an experiment continued for five seasons has shown that at equal planting distances the conventional post-and-wire system promotes higher yields than two other methods which dispense with permanent supports. These methods consist of arching the canes over from stool to stool or tying them into erect bunches. Whenever, as in these systems, raspberry canes are closely bunched together, they are less productive individually than when spaced out on wires. This is probably due mainly to a reduction in the numbers or quality of the fruiting laterals, but other factors involved are the susceptibility of erectly bunched canes to wind damage and the tendency for the flowers on arched-over canes to suffer excessively in spring frosts. The arching method, however, is neat and can be useful for small plantations, especially on slopes. Because of their smaller height, the rows can be planted more closely together to give increased cane populations and yields.

The extent to which cane populations should be enlarged by retaining greater numbers of canes per individual stool is a matter on which opinions vary. Scottish growers often speak of fruiting about seven canes per stool, but true average numbers in commercial plantations are generally less than this. In an experiment with Malling Promise and Lloyd George, both planted at 6×3 feet and given adequate but not excessive manuring, true average numbers of seven or eight canes per stool (in one year, nine) were fruited for four successive seasons with consistently better results than from smaller numbers. From this it would appear that in well-grown plantations a modest increase could often usefully be made in the number of canes fruited on each plant. This question, however, is almost certainly related to planting distances, manuring and other factors, as well as to the age of the stools.

Another and closely related question is whether raspberry canes should, after planting, be maintained as permanent stools, separated by spaces kept free from weeds and suckers by hoeing, or whether the rows should be allowed to sucker freely and form continuous "hedges" of non-stooled

plants. Under the stooling system, which is almost invariably adopted in Scotland and use of which has been implied up to the present point in this article, most of the new canes retained each year arise from buds formed at the bases of the previous year's canes. With the "hedge" system, more often seen in England, a varying proportion of the canes retained are suckers arising from roots. An experiment planted in 1954 to compare the two systems has so far given better results from stooling, but the choice between the two seems to be mainly a management question, dependent on the area of raspberries being grown. Stooled rows can be cleaned fairly quickly on a field scale by hoeing the spaces with draw hoes, whereas the weeding and thinning of continuous rows takes longer and is more suited to small-scale growing. Well-grown suckers in a properly thinned continuous row are possibly at least equal in quality and fruiting capacity to canes formed from stools, but in practice continuous rows on a field scale become overcrowded, with a consequent lowering of the quality of the canes.

The treatment applied to the tips of newly trained raspberry canes also varies in practice. Most growers remove the tips in mid-winter, the tipping height varying with vigour up to a maximum level at which pickers can still be expected to reach the fruit in the following season. An experiment with the three varieties Malling Promise, Lloyd George and Norfolk Giant has shown that to reduce the tipping height above soil level from 5 feet to 4½ feet, and again to 4 feet, can substantially reduce yield. Where growth is strong and high yield is the main consideration, it would therefore seem unwise to tip at a height of less than about 5 feet. For best protection from wind, the top supporting wire should be not more than 6 or 8 inches below this level. An alternative to tipping is to bend the tops of the canes over and tie them again to the top wire, a method which can be relied upon to produce moderate increases of yield at the expense of the higher cost in training.

Some of the most recent raspberry experiments at Mylnefield are on manuring, and concern levels of application of nitrogen, phosphate, potash and dung and the use of green manure crops, straw mulches and cover crops. It is too early to comment on this work, beyond noting that some results are clearly confirming the importance to raspberries of an adequate supply of quickly-available nitrogen in spring and early summer. Other trials are concerned with methods of soil cultivation and the use of chemical weed-killers. The underlying aim throughout is to enable the grower to select the best cultural treatments for each stage of production of the crop, and so to take fullest advantage of the best varieties and healthiest planting stocks which are at his disposal.

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Cold Stores for Fruit and Vegetables

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Since the publication in 1955 of the joint Ministry of Agriculture and D.S.I.R. Bulletin No. 159, *Refrigerated Stores for Fruit*, there have been important developments in the methods of building and operating cold stores. In particular, new insulating materials and refrigerating plant controls have become available.

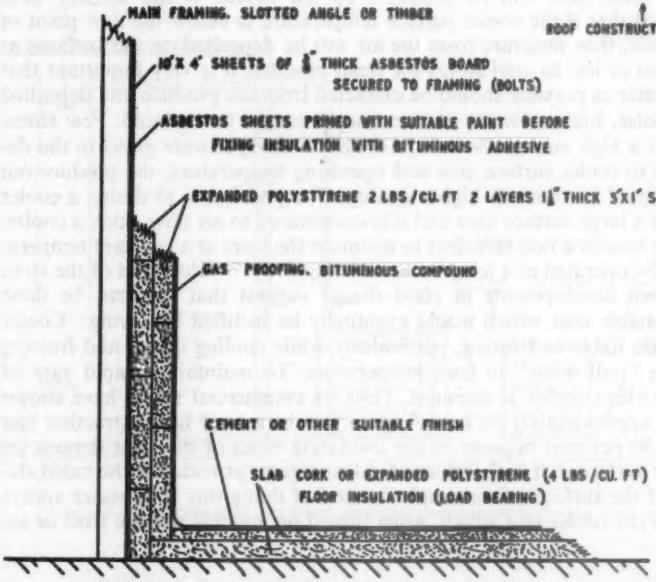
FOR the successful storage of fruit and vegetables it is essential to control the temperature, the relative humidity and in some instances the carbon dioxide (CO_2) and oxygen (O_2) concentrations in the store air very carefully. New cold storage space may be provided by converting an existing building, erecting an insulated structure within a packhouse, or constructing a new external block of stores. Though initial capital and running costs have generally to be kept to a minimum, there are certain basic requirements for a cold store: adequate and durable insulation, a space cooler with adequate surface area, and an air circulating fan with a properly designed air distribution system. If the store is to be used as a "gas" store, it must also be lined inside with a continuous impermeable membrane so that the required conditions of carbon dioxide and oxygen may be established and maintained.

Where the store is an independent external structure, it must be built with load-bearing weatherproof material—brick or concrete; but if the stores are to be erected inside an existing building, a lighter construction may be considered. The diagram opposite and the photograph on p. iv of the art inset show a type of construction, light in weight, needing no special foundations and easy to erect, using readily available materials, and capable of operating satisfactorily down to 35°F. If reasonable care is taken in following the manufacturer's instructions for using the materials, an economical and efficient store can be erected with local unskilled labour.

Insulation

The choice of insulation is one of the most important considerations in the design of a cold store. Insulation must be provided to restrict the flow of heat into the storage chamber, as this heat has to be removed by the refrigerating plant. Of course it is possible to calculate the economic insulation value required, but where fresh fruit and vegetables have to be stored the amount of heat to be removed must be kept to a minimum, as heat extracted by the cooler is almost always accompanied by some moisture from the store air, which the produce tends to replace. Extra insulation above the economic minimum is, therefore, beneficial. For many years slab cork has been the most common insulant for cold stores, but now a number of new insulants have been developed which are proving very competitive in cost, thermal insulating value, and in ease of erection. Perhaps the most outstanding are the expanded plastics; for example, expanded polystyrene, which has advan-

tages of light weight, good insulating value and reasonable cost. A particular advantage of this lightweight material is the ease with which it can be erected with the special newly-developed adhesives. Its efficiency and light weight enable the store structure to be simplified, particularly in regard to roof, door frames, etc. A definite advantage of this lightweight material is the ease with which it can be erected with the use of the newly-developed adhesives, which must, however, be used strictly in accordance with the maker's instructions. Resin board can now be bonded to expanded polystyrene, and so provide a hard, clean, glossy wearing surface. For some cases, foamed *in situ* or sprayed plastic insulants of the poly-urethane type could be used with advantage. To sum up, the insulation of a cold store must have a high resistance to heat flow, be reasonable in cost, permanent, easy to erect, light in weight and proof against moulds and vermin.



Suggested method of construction for an efficient durable cold store in an existing building.

Vapour proofing

Moisture within insulation reduces its effectiveness as a thermal insulator, and damp organic materials may decompose. In the first "gas" stores, the gas-tight lining to the store was provided by securing metal sheets to wooden grounds buried in the insulation. When such a store is in use, in certain conditions of atmospheric humidity, moisture will be able to pass into the insulation. It will condense when the temperature is at the dew point and, as it cannot pass through the metal lining to the coils of the store cooler, will accumulate in the insulation. In many instances this has caused so much rotting of the timber grounds that the store has had to be rebuilt. To guard

against failure of this type, it is advisable to treat the inside surfaces of the store with a good moisture-proof preparation, such as bitumen, before fixing the insulation. To be satisfactory, the vapour barrier must be continuous on walls, roof and floor.

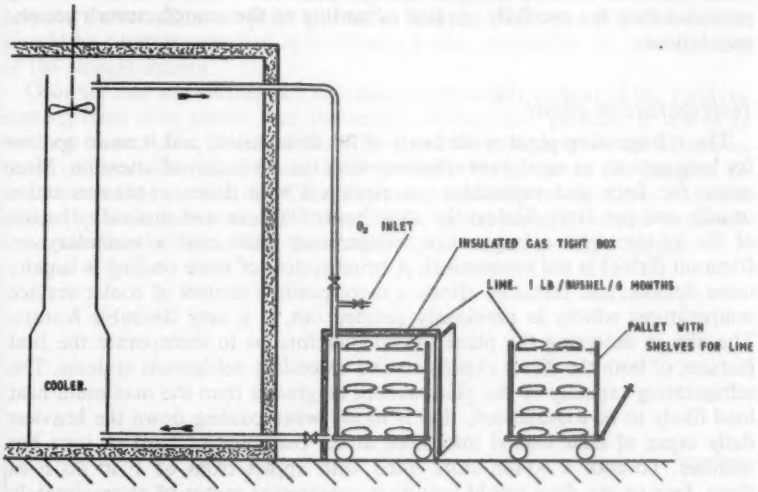
Air coolers

The air cooler has to extract from the store heat which is produced by the fruit, by the air circulating fans and by leakage into the store through the walls, roof and floor. The rate at which this heat is extracted from the store air depends mainly on the speed of the air over the cooler surfaces, the amount of cooler surface area, and the difference in temperature between the cooler surface and the air passing over it; if any or all of these quantities increase, more heat will be extracted by the cooler. It has already been pointed out that if the cooler surface temperature is below the dew point of the store air, then moisture from the air will be deposited on the surfaces as water, frost or ice. In cold stores for fresh produce, it is very important that as little water as possible should be extracted from the produce and deposited on the cooler, because water once extracted cannot be replaced. Few stores operate at a high enough humidity; if careful thought were given in the design stage to cooler surface area and operating temperature, the produce out of store would be of much higher quality. The problem is to design a cooler which has a large surface area and a low resistance to air flow. Such a cooler, extracting heat at a rate sufficient to maintain the store at a constant temperature, can be operated at a temperature of only 2°–3°F below that of the store air. Modern developments in plant design suggest that this can be done at a reasonable cost which would eventually be justified by savings. Cooler surfaces are liable to frosting, particularly while cooling down, and frosting delays the "pull down" in fruit temperature. To maintain a rapid rate of cooling, a clean cooler is essential. Tests on commercial stores have shown that after approximately 36 hours' operation the rate of heat extraction had fallen by 50 per cent because of the insulating effect of the frost deposit on the cooler surfaces: it is therefore an advantage to provide for the rapid defrosting of the surfaces. One simple method of doing this is by water sprays fitted over the cooler unit which, when turned on, quickly remove frost or ice deposits.

Fans and air distribution

Fresh fruit and vegetables are living organisms, taking in oxygen and giving off heat and CO_2. For example, Bramley's Seedling apples stored at 37°F give off approximately 1,000 B.t.u.s of heat per ton a day, and CO_2 at about 1·5 cu. feet per ton daily. This heat of respiration has to be continuously removed by the refrigerating plant. In cold stores, it is transferred from the stack of fruit to the cooler units by air, and for a satisfactory temperature distribution the circulating air must be evenly distributed throughout the produce. If it is not, a temperature difference of 3–4°F may exist between different positions in the stacked produce, a difference so great that it could result in some of the produce being spoilt. The store must have a fan which will circulate air fast enough to ensure efficient transfer of heat

from produce to the air and also from the air to cooler surfaces, against the resistance offered by the stack of fruit, the cooler unit, and any ductwork incorporated in the system. Many 50-ton storage chambers are equipped with a cooler unit in the centre of the store, which has proved satisfactory provided the store is approximately square. For larger stores, and for those which are to be mechanically loaded, it may be more convenient to site the cooler unit against one wall. Where this is done, some air distribution system must be provided, possibly in the form of a delivery duct running the length of the store, and the air discharged from ports in the duct at a uniform rate—so many cubic feet per foot run of duct. The air is usually circulated vertically through the stack and it is, therefore, important that the produce is stacked clear of the floor, the space below acting as a suction chamber.



Proposed arrangement of gas store scrubber using fresh hydrated lime in bags.

Gas proofing and ventilation

Some varieties of fruit keep better in an atmosphere containing more CO_2 or less O_2 than normal air. When storage under these conditions is contemplated, it will be necessary to provide a lining to the walls of the store which is reasonably impervious to CO_2 and O_2. The CO_2 produced by the fruit will be allowed to accumulate to the desired percentage and then, by control of the ventilation with outside air, will be maintained at this level. If a reduced O_2 level is required, some form of "scrubber" will be necessary; that is, a means of circulating the store air over or through material absorbing CO_2. For many years the apparatus to do this scrubbing has consisted of a tower containing either a milk of lime or a caustic solution, through which air drawn from the store is circulated. The CO_2 is absorbed, and replaced by an equal volume of fresh air, each cubic foot of which contains only one-

fifth of a cubic foot of oxygen: the "scrubbed" air is then returned to the store. Hence by regulating the scrubber plant and the amount of fresh air ventilation, the required concentrations of O_2 and CO_2 can be maintained. A disadvantage of lime or caustic solutions is that when exhausted they must be replaced by a fresh charge, possibly every two or three days. An enthanolamine solution to absorb CO_2 has the advantage that, when exhausted, it may be regenerated by heating to drive off the CO_2, and the "scrubbing" process made automatic. A recent development suggested by C. A. Eaves of Canada is that whole bags of slaked lime are placed in a container through which store air is circulated, and any CO_2 absorbed. When exhausted as a CO_2 absorbent the lime may be used on the land.

The lining for the "gas" store may be metal sheets lapped and secured to suitable grounds in the insulation, or a rendering of bitumen compound direct on to the insulation. Bitumen compounds have proved satisfactory provided they are carefully applied according to the manufacturer's recommendations.

Refrigerating plant

The refrigerating plant is the heart of the installation, and it must operate for long periods at maximum efficiency with the minimum of attention. Most stores for fruit and vegetables are equipped with direct expansion units, usually one per store. Unless the store holds 500 tons and upwards, the use of the system with a large main refrigerating plant and a secondary refrigerant (brine) is not economical. A brine system of store cooling is usually more flexible, and certainly allows a more positive control of cooler surface temperatures which, as previously pointed out, is a very desirable feature. The aim in designing the plant should therefore be to incorporate the best features of both the direct expansion and secondary refrigerant systems. The refrigerating capacity of the plant should be greater than the maximum heat load likely to be experienced, that is to say when cooling down the heaviest daily input of fruit loaded into store direct from the orchard in very hot weather. To cool a 50-ton store filled with apples from 65°F to 40°F in three, four or six days would require a compressor motor of approximately 6, 4½ or 3½ h.p., depending on the store loading rate and the plant efficiency.

All machinery and control gear should be easily accessible for cleaning and maintenance. Units with air-cooled condensers should be where they will receive an adequate supply of clean and cool air. The practice of installing the compressor unit on top of the stores is not recommended: space may be saved and the run of refrigerant pipes reduced, but these advantages may easily be offset by unfavourable plant operating conditions—dust, high condensing temperatures, etc.

Humidity

In the storage of "live" produce, correct humidity is most important if wastage is to be avoided. In almost every store the humidity is too low and could, with advantage, be improved. The problem is how to ensure a reasonable relative humidity of about 90–92 per cent. In new construction it can be solved without serious difficulty by efficient insulation and reasonable

cooler surface area, with the temperature of the surface regulated by modern control methods. Humidity conditions could often be improved by the use of water atomizers in the stores. In some instances, however, the addition of water to the store air may only add to frosting troubles with the cooler.

Reliable instruments

To maintain the required temperature and CO_2 concentrations in fruit stores, accurate and reliable instruments must be provided. Once a store is loaded and the required conditions established, access is not practicable and complete reliance has to be placed on remote reading instruments. At least two thermometers should be provided for each store, and if the stores are "gas" stores, CO_2 and O_2 instruments are also required. The instruments should be read at least once each day and logged, together with any other relevant information on plant operation and maintenance. All instruments should be carefully checked at least once a year, preferably at the beginning of the storage season.

Growers and wholesalers are becoming increasingly critical of the produce coming from cold stores, and the length of time that produce is stored is tending to increase. Hence, defects in a store's performance are becoming more obvious. The time seems to have come for stores to be designed to some standard specification. This need not necessarily be rigid, but it should cover the basic requirements of insulation, plant capacity, cooler performance, air distribution and, in the case of "gas" stores, gas-tight linings.

Farmers' Machinery Syndicates

A. R. L. AYLWARD
Farringdon, Alton, Hants

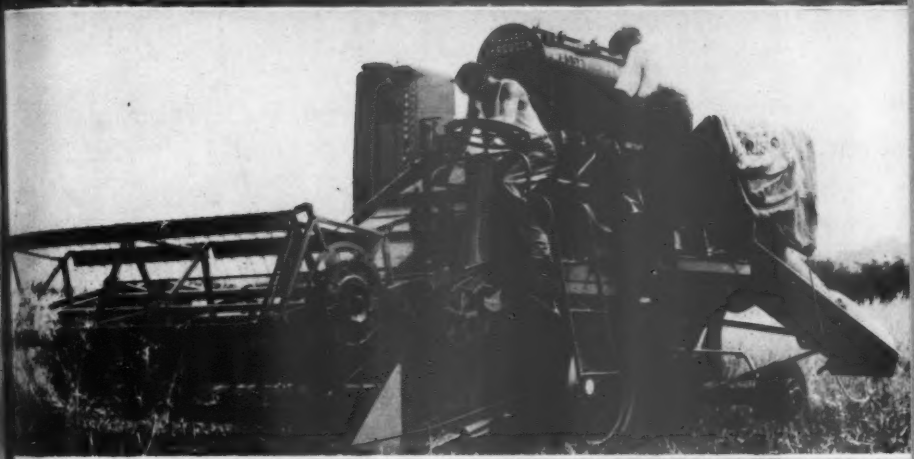
Modern farming rests on mechanization, but costs, especially to the small farmer, can be restrictive of enterprise and efficiency. The answer which Mr. Aylward gives is local co-operative effort—the formation of Farmers' Machinery Syndicates.

I THINK I would be right in saying that the seed of Farmers' Machinery Syndicates was first sown in 1940 when, because of the difficulty of getting our corn threshed at the time we required it, I persuaded three neighbours of mine to buy a threshing machine. This machine was second-hand and as soon as was practical after the war we replaced it by a new one. Our venture, although it served a very useful purpose, created difficulties for the simple reason that it was not organized on a business footing. But having had this experience, it was easy to see that if co-operative use of farm machinery was to be successful a very carefully pre-arranged scheme had to be evolved. It was also obvious that if the small and medium-sized farmer was to compete on an economic basis with the large farmer and also make life easier, means had to be found whereby machinery could be obtained and shared at a small initial cost and payments spread over a number of years.

Conception

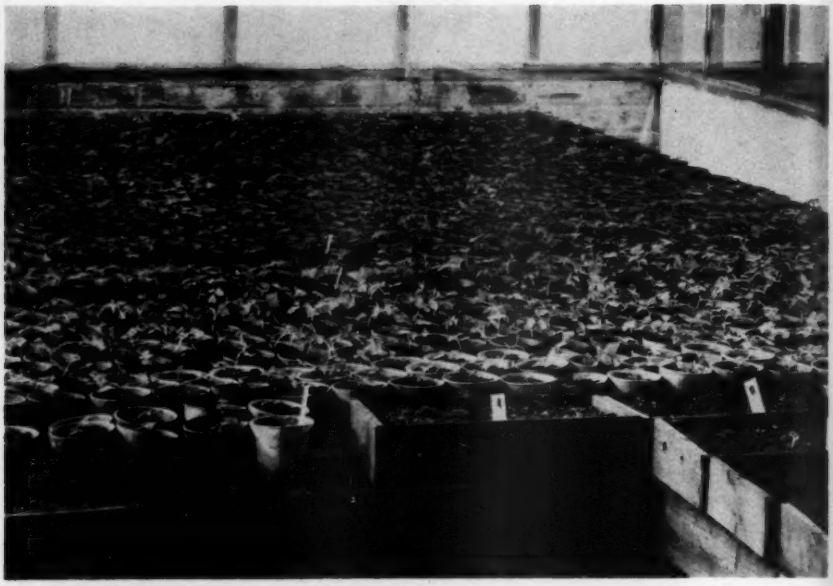
With these objects in view, an approach was made to the National Farmers' Union central organization in 1955 for cheap capital to buy machinery. Mr. Ancrum Evans of this organization and Barclays Bank helped to devise a scheme which was eventually produced for the consideration of the Hampshire N.F.U. Executive, who appointed Syndicate Credits Ltd. Hampshire to be responsible for drawing up the articles, rules and borrowing terms. It is largely due to the thought and work of this Board, first under the chairmanship of Lt.-Col. M. W. Harrap and then Mr. J. N. McClean, together with the county secretaries, that a sure foundation was laid for the success of Farmers' Machinery Syndicates. There are now twenty-three in Hampshire, four years after the first syndicate was formed, and it is incredible how few difficulties have had to be brought to the notice of the Board.

Syndicate Credits Ltd. Hampshire is a governing and advisory body consisting of not more than seven directors, elected by the Hampshire N.F.U. County Branch, with a secretary and registrar of Farmers' Machinery Syndicates, whose liability is limited to £1. Its object, as laid down in the articles of association, is to assist in the economic development of agriculture by encouraging the formation of syndicates of farmers to promote and develop co-operation among farmers and the co-ordination of their activities, particularly in regard to the acquisition, maintenance and use of farm machinery. As previously stated, Syndicate Credits Ltd. is purely a govern-



Photos: *Edwin Plomer*

A ditcher, combine harvester and sprayer are some of the items of equipment available to members of the Farmers' Machinery Syndicate in Hampshire.

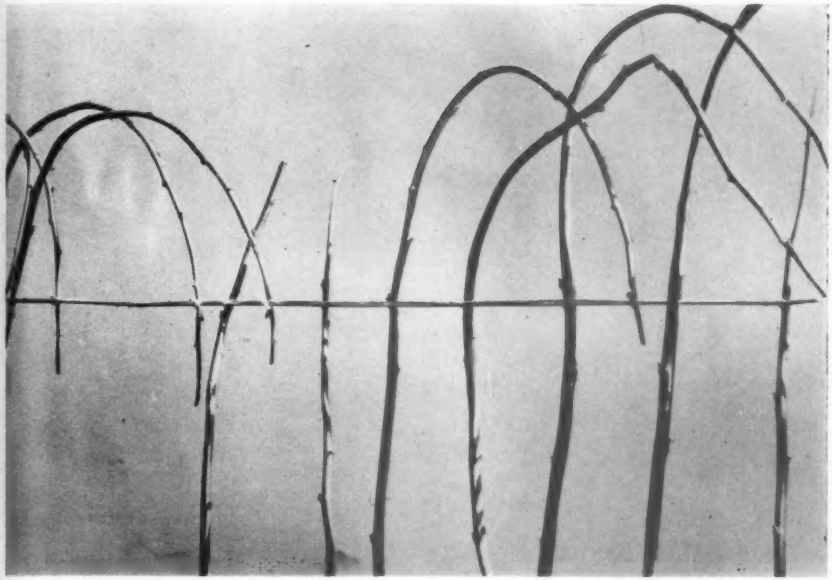


Virus-free stocks are intensively propagated under glass to produce the plants needed to establish cane nurseries in the field.

Photos: *Scottish Hort. Res. Institute*

Some of the more recent Mylnefield experiments on plantation management.

(Article on pp. 279–83)

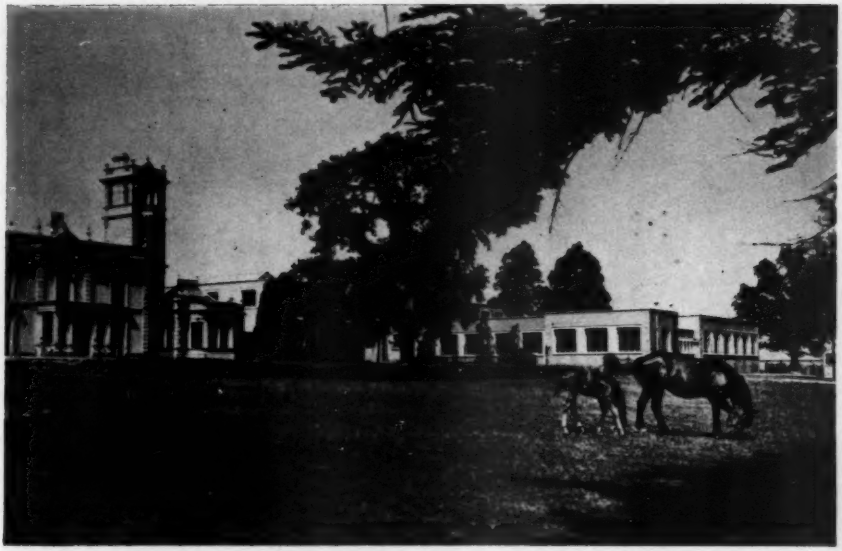


Canes tied down as an alternative to tipping.

Photos: *Scottish Hort. Res. Institute*

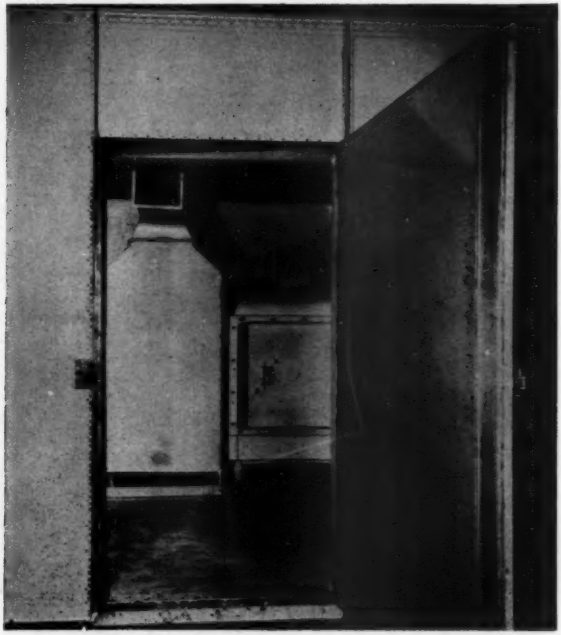
Training raspberry canes without permanent supports.

The Veterinary School, University of Bristol (Article on pp. 272–6)



General view of Langford House and the medicine block.

Cold Stores for Fruit and Vegetables (Article on pp. 284–9)



A light construction cold store suitable for erection in an existing building. The air cooler is in the centre, and on the right the apparatus for observing the evaporation weight losses from stored fruit.

ing and advisory body; it does not interfere with the internal working of a Farmers' Machinery Syndicate. It insists on seeing the local rules which each syndicate must draw up for the operation of their particular machines and inspects reports on the machinery's condition which the syndicate has to have made by a qualified person. It also advises on the suitability of a machine for a particular purpose, but leaves it to the syndicate to select a particular type of machine so long as it is not going to be overloaded.

How the syndicate works

One of the secrets of our success is that the machine must be right for the job it will have to do. Having decided on the type of machine, and the loan having been approved, the Farmers' Machinery Syndicate orders the machine from a dealer of its own choice, and pays 20 per cent of the cost of the machine to Syndicate Credits Ltd., which then applies to the bank for the loan of 80 per cent and pays the machinery dealer.

Thus it can be seen that due thought and consideration is given to the purchase and maintenance of suitable machinery, and this has proved to be of great benefit to small farmers. Also it can be said that Syndicate Credits Ltd., by the duties it performs, gives confidence and stability to Farmers' Machinery Syndicates formed under its guidance. And should there be any trouble with a Machinery Syndicate, here is a body who will give help and impartial advice.

A Farmers' Machinery Syndicate can now consist of as few as two members and not more than twenty with a chairman and secretary. They have to keep a minute book, book of accounts, open a local banking account, insure the machines with the N.F.U. Mutual Insurance Co., and draw up their own local rules. Arrangements have also to be made for the care and maintenance of the machines, and the secretary has to arrange for an engineer to inspect the machines every six months. His report is shown to the members and also passed on to Syndicate Credits Ltd. Labour requirement is dealt with in the local rules: sometimes it is based on one man one machine with labour replaced or paid; in other cases each individual arranges to work the machine when on his farm.

This is just an outline of the composition and working of Syndicate Credits Ltd. and Farmers' Machinery Syndicates, designed to help small farmers. Further details can readily be obtained from the Agricultural Central Co-operative Association Ltd., Agriculture House, Knightsbridge, London, S.W.1, or from county secretaries of the National Farmers' Union. An explanatory leaflet is also available free from any of the Ministry's divisional offices.

A matter of common sense

Now, perhaps, I should deal with the advantages of joining a Farmers' Machinery Syndicate from the small and medium-sized farmers' point of view. After everything has been said, this is only a matter of pure common sense. If we are going to farm easily and efficiently in this mechanical age, one of the main essentials is to have the use of the most up-to-date machines without being over-capitalized. This is true even if the capital is available—

and in most cases it is not. Whatever the circumstances, it must be right for the small farmer to join a machinery syndicate. To illustrate this let me take my own case. I have 80 acres of corn to combine. In 1955 I joined a syndicate of four farmers, whose total combine corn acreage was 200 acres. An 8 feet 6 inches combine was purchased costing £1,505, and we had to put down £301. My share was £100. A further £50 plus interest on the outstanding balance had to be paid every six months for four years. Therefore in the 18 months I had to find just over £200 capital, in order to get my corn acreage combined, instead of a capital expenditure of £1,500 for a machine to do a week or two's work. I was thus able to invest my £1,300 in poultry which lay eggs, instead of in a combine lying in a shed most of the year incapable of producing anything.

But this is not the end of the story. After four years' work we sold the combine, which had then combined 985 acres, for £1,000. That goes to prove our maintenance scheme worked very well. Now we have bought another similar but up-to-date machine costing £1,775. My share of the capital that had to be found was £116. The same week that I paid this account I received a cheque from our Machinery Syndicate secretary for £328, my share of the proceeds of the sale of the old combine, which leaves me with £212 to invest in improving my farm building and making use of the Government grant which is now available for this purpose.

A root crop today is one of the most expensive to grow, but to help overcome this we have formed a syndicate consisting of six farmers with a precision drill, rotary hoe and a down-the-row thinner. Having regard to their acreages, none of these farmers could justify the expense of buying one of these machines, yet collectively they can more than justify this outlay, and it is making root growing far easier for all of us. Then again, six of my neighbours who have wet land bought a large ditching machine at a cost of over £2,000. This proved most successful, and this syndicate has increased its membership to ten. It is impossible for me to enumerate all the different variety of machines operated by syndicates, but it will be clear enough already that the mechanization needs of small farmers which could not be justifiably met individually, can be economically provided by collective effort.

Fixed equipment too

Last year a new venture was started in fixed equipment. Fourteen farmers formed a syndicate to erect a drying, cleaning and storage plant costing £10,200. Here again, this was very successful, and the members decided to increase the storage capacity of the plant for 1959 at a cost of £2,700. A further loan was granted. A total of 1,003 tons was dried at this plant in 1958, most of it in a very bad condition, and the actual cost of drying and cleaning (taking only labour, fuel and power) was 15*s.* per ton, which is the figure worked out by our accountant. It should be mentioned that in a syndicate of this description, an efficient secretary is essential. Having realized this, we appointed our local accountant—a move which, by instilling confidence and stability, promoted the success of our enterprise. The bank has now agreed that for a project of this description, repayments may be extended over five years instead of four. Another plant on similar lines is

being erected by eighteen farmers seven miles away from the existing plant at a cost of £12,000. Here, again, is the opportunity for the smaller man to compete with the large farmer in storing and marketing his grain in a presentable way and taking advantage of the markets.

At one of our drying syndicate meetings one of our members made a very true remark: if, he said, the small farmer would only join this sort of co-operative and have his corn dealt with in a proper manner, he would not have to go on the market and say how much will you give me for this grain which is neither cleaned nor dried straight off the combine. He would be able to say here is a sample of grain that has been put over an up-to-date plant and is worth the ruling market price. In other words, he is no longer a weak seller and depressing the markets for others. Worked on a quota basis, the small farmer pays exactly the same rate for cleaning, drying and storing his corn as the farmer with a bigger acreage.

New thinking by small farmers

It is true to say that the large farmer can see the advantages of joining a Machinery Syndicate more quickly than the small man. He has learned how to make use of sources of cheap capital that are available, and even a large farmer can become over-capitalized on his undertaking. The small farmer, in general, has in the past been brought up to regard borrowing capital as outside his sphere—something to be avoided. That day has gone, and if the small farmer is to survive and expect his sons to follow him there must be a new outlook on his way of life. Farmers' Machinery Syndicates can and do give that opportunity. Given good will, they must benefit all those who have the foresight and courage to participate. To sum up by one who practises what he preaches (I am a member of four different syndicates and, with my son, a member of six), I feel there is great satisfaction in knowing that you are helping others as well as yourself and, perhaps something even greater which cannot be assessed in pounds, shillings and pence, it teaches us to become good neighbours.

FORTHCOMING MAJOR SHOWS, 1959

The Dairy Show	Olympia, London	Oct 27–30
Smithfield Show and Agricultural Machinery Exhibition	Earl's Court, London	Dec 7–11
National Poultry Show	Olympia, London	Dec 9–11

Profitable Small Farms in West Cornwall

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National Agricultural Advisory Service, South-west Region

An informal approach to farm management problems, and a critical comparison of the profits, outputs and major costs of five farms ranging from 24 to 79 acres.

DURING the last decade, the application of business principles to farming has become increasingly necessary to integrate modern scientific methods with the age-old art of husbanding crops and stock. Because they lacked the capital, small farmers have generally been slower to adopt new methods, but many are now finding they must do so if they are to obtain a reasonable standard of living from their holdings.

Cornwall is a county of small farms: some 6,500 are less than 20 acres and 5,500 more are between 20 and 100. With so many small farmers, whose records and appreciation of business principles leave something to be desired, the N.A.A.S. advisory staff have a difficult problem interesting them in farm management.

In 1954, however, we started a number of evening meetings in farmhouse kitchens. Up to 30 farmers came along, the host farmer and his wife providing refreshments. The informal atmosphere of these meetings made them a success from the beginning, and we found that more and more farmers wanted to take part in them or start up other groups. So in 1958 it was decided to try open meetings in similar comfortable surroundings. Ten such meetings were held in hotels, with attendances varying from 30 to 100.

The accounts of eleven west Cornwall farms for the year 1957–58 were collected and analysed in three groups: under 40 acres, 40–100 and over 100 acres. The profits, outputs and major costs were set out on plastic sheets, using plastic letters and figures, and slipped into boards similar to those used for hymn numbers in churches. In this way the story was built up step by step without presenting a mass of figures to the audience all at once. These farm results were used to discuss the lessons that can be learned from good records, and how the study of them can be used to reduce costs and increase profits.

A living from 24 acres

The smallest farm was 24 acres, which earned a net farm income, including the farmer's own wages, of nearly £12 a week. Most of the total output of £2,757 came from 16 milking cows and 185 hens in batteries. Two or three sows were kept, and the progeny sold as weaners. The output represents £117 10*s*. per acre of the farm. Rent, including rates, was £6 an acre, so it was by no means a cheap farm. Fertilizer costs amounted to £5 4*s*., and total food to £1,054. However, in spite of the high stocking rate, only 2½ lb

concentrates were needed for each gallon of milk produced throughout the year. The poultry enterprise was highly efficient, with almost £4 of eggs sold per bird, and the pigs showed a margin over food costs of £2 10s. per weaner.

Such results sound impressive, but the farmer and his wife had to work long hours, and could rarely get away from the farm. If he is given a standard wage of £360 and his wife half that, the total wage bill (with the casual labour of £74) is £614. Power and machinery costs were £562, which with the labour bill is about 40 per cent of output. As can be seen from later examples, these costs are as great as for twice the acreage. In the case of machinery, the tractor would quite easily deal with twice the acreage, and the milking machine milk twice as many cows. The labour force, on the other hand, is fixed at the farmer and his wife; greater output would be the only possible way of increasing their standard of living. The main cost, however, is bought food; failure to make the best use of this commodity can quickly be the downfall of the small farmer.

In this case I doubt whether cow numbers could be increased economically; and to change from selling weaners to finishing the pigs to pork or bacon weight would need extra accommodation and capital, and these are not at present available. The easiest expansion would be in poultry, for here there is room to double the numbers. Extra cages would have to be bought, but on present performances the expenditure should be worth while.

£20 a week from 35 acres

The farm with the highest profit in the "under 40-acre" group was on 35 acres of poor, black granite soil, where the occupier earned a net farm income of £1,104. The output of £2,606 was obtained mostly from milk, but pigs and 1½ acres of early potatoes contributed about 25 per cent of it. Just over 12,000 gallons of milk were produced, with concentrate feeding at 2.1 lb a gallon. The very satisfactory profit margins are mainly due to a wise use of feedingstuffs; too often on the smaller farm food is wasted and costs are far too high.

The output on this farm is only about half the average for similar farms, according to the results of Bristol University Farm Management Survey, but bought feed costs are only 20 per cent of the average. It is all too common to find small farmers worshipping high output without giving enough thought to the high costs of production involved. These two farmers amply prove that the small farm, at any rate in Cornwall, is quite capable of providing a reasonable living if careful attention is given to details. The net farm income is 50 per cent above the average, and is obtained on half the output of the average farm. Total farm costs on the 35-acre holding were £600 less than on the 24-acre farm; £100 less power costs and half the food bill are responsible for the difference. "Take care of the pence and the pounds will take care of themselves" might well be the motto of the small farmer when looking into his food costs. Only £33 of casual labour was used; the rest of the work was done by the farmer and his wife.

These excellent results indicate the potential on the small farm. The new Small Farmer Scheme is designed to make use of this potential on many more of our small farms.

49 acres yield £30 a week

The 40–100-acre class contains the true family farms. There were five holdings in the group whose net farm incomes ranged from £1,331 to £2,205. Outputs obtained were two or three times the average of the small farm group.

The total output on one farm, of 49 acres, was just over £5,000. Nearly £4,000 came from milk and £500 from poultry, the rest being from sales of surplus cattle. Twenty-five thousand gallons of milk were produced from 27 cows, with a concentrate consumption of 3 lb a gallon, 2·9 lb of which was bought. The farm was on thin, hungry, black granite soil; £8 an acre was spent on fertilizers and lime to maintain the level of production. The general organization of the farm was good; the output justified the employment of a man full time, so the farmer and his wife were not completely tied to the holding. Power and machinery costs were no higher than in the two previous examples. The poultry unit of 180 hens in deep litter could not be faulted. Concentrate consumption was higher than on the two smaller farms, but the milk yield of 946 gallons per cow is about 100 gallons a cow more. The net farm income obtained was £1,691.

Two farms not relying on milk

Throughout the examples so far the primary product has been milk; in the next two examples, good profits are obtained without relying mainly on the dairy cow.

In the first, a 54-acre farm, output amounted to £7,076, of which £2,197 was from milk and £4,281 from pigs. The dairy enterprise was only fairly good, producing 14,000 gallons from 22 cows at a food consumption of 3·9 lb a gallon. All this feed was bought. The pigs ate ten acres of home-grown barley, skim milk and some purchased meal; if the home-grown barley is charged at market price, their feed costs amounted to £3,028. Nearly all the pigs are bought at 8–12 weeks old and finished either to pork or bacon. The margin over feed costs is about average, but since most of the pigs were bought the results are satisfactory. Output is £2,000 more than from the 49-acre farm, but net farm income is down to £1,331, or just over £25 a week. All the work was done by the farmer and one employed man. These two produced just over £700 of output per £100 labour, nearly 20 per cent more than the previous example, but the net financial result was less. Power costs were still about the same as in the previous examples.

The land on the 79-acre farm was good quality Devonian. Output totalled £5,703, made up as follows: £1,851 from crops, £901 from cattle sales, £1,419 from milk, £1,187 from pigs and £233 from eggs and £112 sundry sales. The system was thus fairly diverse, and this increased the labour force to three, the farmer and two employed men. Power and machinery costs again were on the same scale as on the previous farms. The net farm income was £2,205.

The cash crops sold were two acres of early potatoes, five of broccoli and nearly two of spring cabbage. These are traditional in west Cornwall and are high cost, high risk crops, because they need a lot of labour for planting and harvesting, and depend on careful marketing. Three acres of wheat, five of barley and just over fifteen of mixed corn were grown and processed

on the farm. Milk production amounted to 11,000 gallons, with a food consumption of 3·8 lb a gallon; 2 lb a gallon was bought and 1·8 lb grown on the farm.

The stock and crops on this farm do not require more labour, in standard work units, than the 54-acre farm already described, so the extra man is necessary only to deal with the peak work loads. Although it is the most profitable farm in the group, the farmer is anxious to give up cash crops because of the peak labour needs. But unless considerable capital is provided for improvements and extensions to existing buildings, there is no possibility of increasing the dairy, pigs or poultry sufficiently to compensate for the loss of income from cash cropping.

Potential of the small farm

There are lessons to be learned, and increases in profitability are possible, on these farms, which all fall in the acreage range of the present Small Farmer Scheme. Inevitably the small farmer depends on milk, pigs and poultry for his livelihood. He must buy and process feed, and use it most carefully, to make his output large enough to leave a reasonable profit to live on, and he must make the fullest use of the acres of land he occupies. The larger the farm, the greater the economy that can be made in feed costs.

The similarity between power and machinery costs on all these farms does suggest that savings could be made, either through the present machinery syndicate procedure or by private arrangement. With the increasing need to mechanize to reduce costs and give the small farmer some free time, farmers' machinery syndicates are becoming increasingly important. They have worked successfully in other parts of the country, and there seems to be no reason why they should not do so under our conditions in the south-west.

These results prove to those who have been cynical of the Small Farmer Scheme that the potential on the small farm, at any rate in Cornwall, is such that 35 acres can provide a very reasonable standard of living to a progressive and careful farmer and his family.

Production of Onion Sets

F. G. SMITH, N.D.H., and A. G. JONES
Stockbridge House Experimental Horticulture Station, Cawood, Yorks

A practical study of the conditions under which commercially acceptable onion sets can be grown and stored in Yorkshire.

IN most of Yorkshire, it is not generally possible to obtain satisfactory yields of bulb onions raised direct from seed. There is a wide interest, therefore, in the production of onions from sets, both commercially and in allotments and private gardens. Sets are usually imported from Holland and are of the variety Rijnsburger, although smaller quantities of the variety Ebenezer are also used.

In 1953 the Advisory Committee of Stockbridge House Horticulture Station at Cawood asked for some investigations to be made into the possibility of producing onion sets in this country. The cost of imported heat-treated sets is high—in the region of 240*s*. per cwt (trade price). A good deal of work was done on the production of onion sets in the south of England by Tincker and Brown and Heath and Holdsworth[1, 2] during the war, and the information they gained was used in working out a technique suitable for the north of England. We in Yorkshire expected the chief difficulty to arise from the ripening and harvesting of the sets at the end of the summer. Because of difficulties in the harvesting of bulb onions raised from seed in the open ground, we decided that the sets should be produced as a summer crop in double-span Dutch light frames.

The onions were sown about 9th May, in a frame bed which was in a reasonably fertile condition after a lettuce crop. To eliminate hand-weeding, we decided on a system of surface steaming. A perforated pipe connected to a low-pressure steam supply is put under a sheet of heat-resistant P.V.C. The edges of the sheet are kept down by a heavy chain, and the steam is injected until the rate of condensation on the surface of the soil is so reduced that the pressure of the steam lifts the sheet uniformly over the area being sterilized. Experience has shown that in this way the surface of the seedbed can be heated sufficiently to kill most of the weed seeds in the top two to three inches of soil. With the equipment used at Stockbridge House, an area of 200 sq. feet can be steamed at one time. The major preparations of the seedbed are completed before steaming begins, and afterwards it is necessary only to rake over the local depressions made in handling the steaming sheet and equipment.

Cultivations

After steaming, the onion seed is sown broadcast, through a tin with largish perforations in the top, to distribute the seed as uniformly as possible. The sowing rate is half an ounce per sq. yard, or two-thirds of an ounce per Dutch light. Seed with a germination of 77 per cent (on test) sown at this rate will give 145 usable sets ½–¾-inch in diameter per sq. foot, or approxi-

mately 1,800 per Dutch light. A larger number of sets per unit area can be produced by higher seeding rates, but the proportion of smaller sets of a size which may be lost during storage is increased; so is the incidence of mildew in the crop. At 1,800 per Dutch light and an average set weight of 9 oz per hundred, the yield per light is about 10 lb. Allowing for a 20 per cent loss of weight during storage at high temperature, this gives a marketable yield of sets of 8 lb, worth approximately 17*s*., per light. From experiments conducted on the cropping of onion sets, this size (½–¾-inch) appears to be the most satisfactory commercial grade. After sowing, the seed is covered to a depth of about ¼-inch with sifted, sterilized soil. Normally, re-sterilized old potting compost is used for this purpose: but it *must* be re-sterilized, otherwise quite a high weed population can easily be introduced. A light watering is given, through a fine rose, to settle the seed in, and afterwards the lights are placed on the frame.

Dutch lights lined with polythene have been used when available, and we have found that they give a certain amount of shade to the seedbed which prevents excessive drying-out until the seed has germinated. Alternatively, it is desirable to put some sort of shading on the lights to avoid the necessity of frequent watering, as the hot sunshine during May can quickly dry out the surface soil during the period of germination. Usually, germination is rapid, and as soon as most of the seedlings are through the soil the frames are ventilated. They remain covered until the cotyledons have straightened out, and then the lights are removed, normally at the end of May or the beginning of June. The seedlings grow quickly during June and, because they are thick on the ground, may show signs of nitrogen starvation towards the end of the month. This tendency has been corrected by watering with a solution of potash nitrate (1 oz to 2 gallons of water). Because of the high population of seedlings, there may be some tendency for downy mildew to develop during July: at Stockbridge House this has been checked by applications of zineb, repeated at approximately fortnightly intervals. It is important that the disease should be checked, otherwise losses will be heavy.

Towards the end of July, small bulbs about the size required for onion sets will form at the bottom of the plants; when these have reached about ¼-inch in diameter a final application of fungicide to control mildew should be made, and the lights replaced on the frame to keep off the summer rain. The ridge-board of the frame is raised so that the lights are at least a foot above the tops of the onion growth, thus allowing air to pass freely over the crop. The set size is controlled by the timing of the re-covering of the frames, although it depends partly on the sowing rate.

When kept dry, the sets will ripen off fairly quickly and should be harvested in the second half of August. They are usually gathered into trays with ¼-inch mesh wire bottoms; for example, half Dutch bulb boxes. These trays are then stacked in a glasshouse, so that the sets may finish drying off and ripening. It is important that the sets should dry off thoroughly, otherwise they may rot.

Storage at high temperatures[3, 4]

A number of varieties have been used to produce onion sets at Stockbridge House, but it is necessary to mention only four of them. Rijnsburger (Dutch

seed) and Best of All are the two round-bulb onions used successfully so far. Unless the sets of these varieties are stored at a high temperature, a large proportion of them will go to seed when grown on the following year. The two other varieties worthy of mention are Sharpe's Big Ben and Stuttgarter Reisen: both of these, when stored at normal temperatures, are much less likely to bolt than the other two. Strain is important, however, and there is evidence that not all strains of Big Ben behave in the same way. At Cawood the Sharpe's strain has been used exclusively.

A storage temperature of 82°F with high humidity is recommended. This has been our aim; the temperatures of the stores at Cawood have varied between 73° and 84°F. Variability within these limits appears to be acceptable, since the storage treatment has been successful in reducing, and in most cases eliminating completely, the tendency of onion sets to bolt. The storage period has lasted from mid-October to mid-March, when the sets have been taken out of the stores ready for planting.

Investigations on the cropping of onion sets have shown that the larger the set, the greater the tendency to go to seed, whatever the variety or storage treatment. Generally speaking, sets of Big Ben and Stuttgarter Reisen up to ¾-inch in diameter show little tendency to go to seed, whether they have received heat storage or not. Similar sized sets of Rijnsburger and Best of All produce seed-heads freely unless heat stored, but they seldom bolt if heat stored.

Experiments with the cropping of sets have also shown that if bolting can be eliminated, the larger the set used the larger the yield. But since onion sets are sold by weight and not by number, the larger the set the higher the cost of planting per acre at a standard planting distance. Also, as heat storage does not entirely eliminate bolting in sets of the globe varieties over ¾-inch in diameter, sets ½–¾-inch diameter seem to be the most suitable commercially.

With all varieties, crops produced from heat-stored sets are more vigorous, later in maturing, and bolt less readily than those stored at normal temperatures. Heat storage therefore markedly increases the yield per acre of bulb onions raised from sets.

It has been found that sets decrease in weight during the period of heat storage; this is due chiefly to moisture-loss, although a number of sets, particularly in the smaller grades, dry up and are lost entirely. In our experience the loss of weight during storage has varied from 10–25 per cent, and the wastage in numbers has been about 12 per cent. The wastage of the globe onion varieties, which produce rather elongated sets, is greater than in the flat varieties, which produce round sets.

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Eradication of Bovine Tuberculosis in the Isle of Man

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There were about fifteen tuberculin tested herds in the Isle of Man in 1948, and bovine tuberculosis was rife. But by 31st March 1956 every herd was attested.

BOVINE tuberculosis has been a serious problem amongst Manx cattle for a long time. Undoubtedly it was aggravated by the use for many years of beef bulls on dairy cows, which made dairy farmers seek replacements outside their own herds. The constant interchange of cattle resulted in a high incidence of tuberculosis, particularly in dairy herds. This practice decreased considerably during the war, when an Artificial Insemination Centre was set up and more dairy bulls were used, but the infection had been spread and the damage was already done. About 100 animals showing clinical signs of the disease were slaughtered annually, but many more must have died from it each year. It was estimated that approximately 60 per cent of all cows were infected and that in some herds every cow would react to the tuberculin test. In the abattoirs 1,000 carcasses showing lesions of tuberculosis were found every year.

The total cattle population in 1949 was 25,000, including 7,000 cows or heifers in milk. There are some 900 holdings on the Island, most of which are engaged in mixed farming.

Several schemes were considered, but it became evident that the disposal of reactors would be difficult. It was finally decided that slaughter on the Island would be the best solution. If there had been any attempt to unload large numbers of live reactor cattle on to the English market, there would undoubtedly have been considerable opposition from English farmers, so the chosen scheme provided for the removal of reactors by the Government as soon as slaughter arrangements could be made. The owners were paid the full market value of slaughtered cattle.

Attested scheme

There were approximately fifteen "tuberculin tested" herds in 1948 and it was decided to introduce an "attested" Scheme on 1st April 1949. To help attested herd owners buy replacement cattle, the Government paid them a bonus of 4*d*. a gallon on all milk produced or, if the herd was not recorded, a sum based on an estimated gallonage of 400 gallons per cow in the herd. In beef herds a *per capitum* bonus was paid.

At first the scheme was voluntary, but gradually small areas began to appear in which all or most of the farms had entered it. The Isle of Man Board of Agriculture had power to declare such areas "eradication areas" and to compel all neighbouring herd owners to join the scheme.

The scheme made a slow start, many owners being reluctant to enter until they knew what their neighbours were doing. In some cases there was considerable opposition, owners threatening to go out of farming if they were forced into the scheme. Not one of these threats was carried out; in fact many of those who were most actively opposed to tuberculosis eradication are now amongst its strongest supporters. Once the majority of Manx farmers had become used to the idea, the speed of progress was limited only by the Island's ability to slaughter and absorb all the reactor carcasses. For a short time in 1952 the scheme was slowed up by the outbreaks of foot-and-mouth disease in England, Scotland and Wales, which limited the importation of replacement stock.

The annual intake of herds into the scheme shows its progress:

1st April–31st March	No. of attested and supervised herds
1949–50	113
1950–51	199
1951–52	370
1952–53	529
1953–54	675
1954–55	979
1955–56	1,000 (all attested)

The percentage of reactors disclosed at the initial tests of herds entering the scheme gradually fell from about 30 per cent in the early days to about 20 per cent in the later stages. There was great variation in the number of reactors found in the herds. A few self-contained herds had none, but in others all the animals reacted. The overall percentage of reactors at the initial test was 26·05 per cent; at the second test, 3·12, at the third 1·24, and at the fourth 0·63 per cent. Much useful information was obtained from post-mortem examinations of all reactors, the carcass in each case being identified with the live animal.

Replacement cattle were imported from attested herds in England, Scotland and Wales, through Liverpool. The traditional breed in the Island for many years has been the Shorthorn, but supplies of Shorthorns were not plentiful during the early stages of the scheme, so many Ayrshire females were imported. On the whole the replacements were better milkers than the animals they replaced, and this increased our surplus of milk and the problems of disposing of it. In addition there was a continual shortage of calves for rearing, because of the slaughter of in-calf females and their replacement by cows in full milk.

During the later years of the scheme more replacements became available in the Island and the imported animals were mostly Dairy Shorthorns and Friesians.

Cost of the scheme

The cost of the eradication of bovine tuberculosis was borne entirely by Government funds. Annual votes in Tynwald of sums ranging from £40,000 to £60,000 made available a total of £328,000.

The actual expenditure up to 31st March, 1955 was less than this, and was made up as follows:

	£	s.	d.
Milk and *per capitum* bonus	111,139	5	0
Compensation	292,834	6	1
Cost of testing, travelling, etc.	14,998	11	9
Printing and advertising	670	18	10
Carriage and slaughter of reactor cattle	3,587	8	7
Miscellaneous	309	12	9
	423,540	3	0
Less salvage of reactor carcasses	129,184	18	8
	294,355	4	4

The average compensation paid for each animal was roughly £40, and the average amount of salvage obtained approximately £18 per animal slaughtered.

Benefits of eradication

The Manx Eradication Scheme has been costly by reason of the high incidence of bovine tuberculosis when it started, and the comparatively large amount paid as milk bonus; but it has brought many benefits to both the human and cattle populations. Before the eradication of bovine tuberculosis, a ward in Nobles Hospital was devoted entirely to the treatment of children suffering from the effects of bovine tuberculous infection: it is no longer needed for this purpose. Farmers' losses as a result of the disease have steadily decreased. This can best be illustrated by the annual figures for clinical cases compulsorily slaughtered and the number of carcasses found to be affected with the disease in the Island's abattoirs.

	Clinical cases of tuberculosis	Affected carcasses in abattoirs
1950	92	1,010
1951	39	876
1952	41	779
1953	32	652
1954	14	439
1955	3	213
1956	Nil	24
1957	Nil	1

There have been other, not quite so obvious benefits to the farmer. The general health of all cattle has undoubtedly improved: more animals have been reared to maturity and at less expense. Some owners, particularly those with herds previously heavily infected with tuberculosis, have remarked on the increased thriftiness of the livestock. Before eradication, some 1,200 Irish fat cattle were imported annually: today the Isle of Man is self-supporting in beef. As a holiday resort, the Island had to have milk supplies as free as possible from infection. All milk supplies are now safe from the danger of tuberculosis. Manx livestock may now be exported through an attested section of Birkenhead Lairs, and may enter attested herds in England, Scotland and Wales without further tests. A number of cattle diseases have fortunately never spread to the Isle of Man, and the eradication of bovine tuberculosis must make Manx cattle now among the healthiest in the world.

Scientific Research in Agriculture

THE post-war years in Great Britain have been a period of marked expansion in research on the problems of farming and the agricultural industry generally. The latest report of the Agricultural Research Council*, which deals with the year 1957–58, records an official expenditure on the particular agricultural research which it supports, of close on £5 million. Ten years ago the corresponding figure was £1·65 million. Nevertheless, £5 million is not a large sum when considered in relation to the nation's agricultural output. It is about 0·3 per cent of our gross farm income, matching quite closely the percentage spent in the United States. Many other industries, in both countries, spend a much higher proportion of their income on scientific research. Even when one has allowed for the development work of the Ministry of Agriculture experimental husbandry farms and horticulture stations and the growing contribution made by the research organizations of the commercial companies serving British agriculture, the total amount of money being devoted to agricultural research here can hardly be called extravagant.

In the early days, agricultural research was not centrally organized. The older institutes such as Rothamsted were founded by individual endowment. Others, like East Malling, were formed by groups of farmers and growers who recognized that scientific methods could help solve the special problems of their own branches of the industry. Or, like the A.R.C. Field Station at Compton, they were officially sponsored to fill gaps in agricultural research service.

Gradually, as research activities expanded and became more costly, all these independent organizations came to rely more and more on Government support, until now 90 per cent of their income is derived from official funds, administered directly by the A.R.C. in England and Wales, and with the Council's guidance in Scotland. Altogether, the Council is responsible for twenty-three institutes and nineteen smaller agricultural research units. Its annual report, which contains brief summaries of the main lines of work in progress at each one, thus provides an illuminating survey of where and how the many pressing problems of farmers and growers are being tackled. For those whose appetite for further detail is aroused, more information about specific research projects is obtainable in the reports issued by the individual institutes.

But is sufficient effort being made to see that research results actually reach those whom they most concern? Recent correspondence in the farming press suggests that in some people's view there is still room for improvement. Research is of no value to agriculture until it is assimilated into everyday practice, and technical information takes a long time to spread. The Agricultural Improvement Councils are the "official channels", both for communicating farming problems to the A.R.C. and for handing back the answers. Advisory officers of the N.A.A.S., and many of the research workers

* Report of the Agricultural Research Council, 1957–58. H.M.S.O., 8*s*. (8*s*. 6*d*. by post).

themselves, are in daily contact with farmers and write about the latest developments in scientific and farming journals in Ministry bulletins and leaflets.

This year, the A.R.C. has augmented this flow of information by including in the annual report, for the first time, a series of articles covering research progress on nine subjects of current interest. They illustrate the enormous range of the research programme, for they deal with poultry and potatoes, fertilizer placement and weed control, trace-element deficiencies in crops and stock, and the application of modern genetic principles and the electronic computer as research tools. Other subjects are to be dealt with in the same way, so that over a number of years the whole work of the Council will be surveyed in a condensed form, suitable for general, if not entirely light, reading.

This year's summary of poultry research emphasizes the enormous expansion of the poultry industry, and the rapid trend towards more and more intensive management. Broiler production was nil in 1950. By 1960, if present progress is maintained, it will reach 100 million. Up to 70 per cent of commercial egg production comes from intensively-housed flocks. In 1957–58 the poultry industry's output reached £204 million. The problems arising from this spectacular expansion are being countered by a correspondingly fast increase in poultry research facilities. Disease control—a crucial factor in maintaining output—is being investigated. Much attention is being paid to the economics of meat and egg production, and to the quality of the products. The environmental conditions most suited to each class of bird at different stages of life are also being studied.

Farm buildings generally are the object of current surveys organized by the Council. The ultimate aim is to use existing knowledge as a basis from which better buildings can be developed. This refers not only to the details of structure as such. It includes the less tangible elements of temperature, humidity, and atmosphere inside buildings intended to house stock. Very little is known about the ideal environments required by different farm animals, though clearly these may greatly affect their health and productivity. A new "climate lab." for pigs, is being built at the A.R.C. Unit of Animal Physiology, Babraham, Cambridge.

Another new laboratory began active work at Wantage in January last year. This is the Radiobiological Laboratory responsible for monitoring radio-active fallout in soil, herbage, farm animals, milk and other foodstuffs.

A great deal of agricultural research in Government Departments is directed towards solving specific, practical problems, but there is also a need for work that adds to the store of fundamental scientific knowledge. For example, plant and animal viruses cause great damage and loss in crops and stock. Clearly, the search for control methods likely to be immediately applicable is essential. Less obviously useful, but equally important in the long run, is the investigation of the nature of the viruses themselves, for this may eventually lead to better methods of combating them.

Often, work on one subject helps with a totally different problem. A number of serious plant virus diseases are spread by aphids. Researches into the life history and behaviour of *Myzus persicae*, the greenfly that spreads leaf roll and rugose mosaic in potato crops, and yellows in sugar beet, have

played an essential part in the development of insecticidal spraying techniques, which are now used increasingly to protect these crops. Such sprays, when properly used and correctly timed, can prolong the life of stocks of seed potatoes in south-east England for up to five years; and in some years they have increased the yields of sugar beet roots by several tons an acre.

Sir William Slater, Secretary of the A.R.C., said recently that in this country agricultural research had never been held up for lack of funds; the limiting factor had been shortage of trained men and women, especially in the newer and less well-established fields of work, a difficulty which fortunately seemed to be receding. There is no doubt that there is ample opportunity for satisfying and rewarding scientific work in the service of agriculture.

Sylvia Laverton

Farming Cameo: Series 2

18. Central Flintshire

N. A. Jones

Deputy County Advisory Officer

Flintshire is made up of three separate blocks of land. The central district, a compact area covering the south-east half of the mainland, is bounded to the north by the Dee estuary, on the west by the Clwydian range, and merges in the east with the Cheshire plain. Mold, the county and market town, is in the middle, but much of the agricultural trade flows through Chester, which is less than a mile over the boundary. Most of the goods and holiday traffic from Merseyside to the North Wales coast passes through the district, presenting quite a problem on farms split by the main roads.

Several types of soil occur in the district. These are mainly drift soils over limestone or Millstone Grit, with a belt of Coal Measures lying north and south. No deep mining of coal takes place at present but small areas have been opencast mined. Soils derived from Triassic drift are found along the north-east, and are generally fertile. Much of the remainder comes from Millstone Grit or Carboniferous Limestone with local drift. These are less productive.

The area has been favoured in that industry has developed alongside agriculture, so providing a ready market for farm products. The large number of scars left by derelict coal and lead mines indicate the industry of the past, while the tall chimneys and cooling towers on Deeside show the extent of the large steel, textile and aircraft works which provide jobs for large numbers of the population but also compete strongly for agricultural workers.

The land rises from sea level to just over 1,100 feet, with no large areas of rough land except the 1,200 acres of common land on Halkyn Mountain, which is below the 1,000-feet contour and grazes about 1,000 sheep and 200 head of cattle.

With an annual rainfall of 30–35 inches, conditions generally are suitable for most crops. Grass is high priority and is receiving more and more atten-

tion, in an effort to cut production costs. Leys are usually put down for four years or more, but Italian ryegrass as a catch crop or short ley for early spring grazing is fast becoming general practice.

One half of the holdings are under twenty acres and are worked part-time; most of the others are under one hundred. It is inevitable that under such circumstances the basis of the farming system centres on milk production, and in fact nearly 80 per cent of the holdings are registered for this.

Friesian-type cows have greatly increased in numbers over the last few years and are now the predominant breed. The numbers of producer-retailers have fallen considerably recently, and retailing is now mainly in the hands of the larger dairymen. Cheese-making has disappeared completely.

About 25 per cent of the crops and grass area is under the plough, producing 1,000 acres each of wheat and barley and about 500 acres potatoes; the remainder is in fodder crops. A noticeable trend lately is the swing away from roots in favour of kale, and from oats to barley, no doubt due to labour shortage in the former and to the higher yields possible from the newer varieties of barley in the latter.

The introduction of the Silo Subsidy Schemes has enabled farmers to provide worthy accommodation for their silage. Roofing has meant a higher dry matter content and consequently higher feeding value. Good walls have practically eliminated waste at the sides. Early tedding of hay is becoming more widely practised and should materially enhance its feeding value in time.

Sheep are popular on most farms, except around the more densely populated areas, where worrying by dogs makes them unprofitable. In these areas pigs and cash crops are more attractive as subsidiary enterprises. Poultry are kept on almost every holding, especially since the deep-litter system became an accepted practice.

The buildings for housing live and dead stock, with the possible exception of cowsheds, are outdated and inadequate for the present stock-carrying capacity of the land. The Farm Improvement Scheme has given an impetus to the programme of reconstruction, and improvement is now taking place. Loose housing of stock is becoming more popular and new building work and adaptations are being planned, with provision for the mechanical handling of fodder and dung.

The standard of mechanization is high, and it is rising in spite of the high capital cost involved. The drift of agricultural workers to industry leaves very little alternative. Machinery syndicates may help to reduce cost, but few farmers are prepared to commit themselves to firm agreements as yet. Many, however, have a loan-for-loan arrangement with their neighbours, and on the smaller farms baling, combining and spraying are done by contractors and farmer-contractors.

Most of the rough grazing which could be economically reclaimed is now in grassland and contributing materially to the economy of the farms concerned, even though the cost of maintenance is rather high.

During the late eighteenth century the Dee was canalized from Chester to Connah's Quay, to allow larger ships to sail into Chester. During the process, about 4,000 acres of saltings were reclaimed for agriculture by warping. This area of marine alluvium is particularly suitable for market gardening; the soil is free working and has a high water-table. At present about 1,000

acres are in fact devoted to market garden and nursery crops, and the remainder to dairy and arable farming.

The rapid expansion taking place in industry has increased the demands for building land, and serious inroads are being made into the best agricultural land. It is gratifying to note, however, that about 500 acres of saltings have been reclaimed by mechanical warpings for the erection of a power station and an extension to a large steel works.

The farmers generally are keen, and for ever on the look-out for new techniques and equipment to improve their income and reduce or eliminate some of the drudgery which has for centuries been accepted as part of farming. While this attitude persists, farming in the district is likely to remain vigorous and progressive.

THE MINISTRY'S PUBLICATIONS

Since the list published in the September 1959 number of AGRICULTURE (p. 239) the following publications have been issued.

MAJOR PUBLICATIONS

Copies are obtainable from Government Bookshops or through any bookseller at the prices quoted.

BULLETINS

No. 43. Cheesemaking (*Reissued*) 7*s.* (7*s.* 6*d.* by post)
The processes of making several of the most well-known of Britain's cheeses are described in the 4th edition of this Bulletin, both on the commercial scale in creameries and as a farmhouse craft. Cream and soft cheesemaking is also described. The Bulletin is illustrated with 41 excellent photographs.

No. 177. Machine Milking (*New*) 12*s.* 6*d.* (13*s.* 6*d.* by post)
In this Bulletin the National Institute for Research in Dairying has prepared for the Ministry a modern, authoritative and comprehensive work which will interest not only farmers but students, instructors and manufacturers. Illustrated with over 100 text figures and photographs, it presents the contributions of acknowledged experts written in the light of the most recent research.

LEAFLETS

One free copy of Animal Health Leaflets may be obtained on application to the Ministry (Publications), Soho Square, London, W.1. Copies beyond this limit must be purchased from Government Bookshops, price 6d. (8d. by post).

ANIMAL HEALTH LEAFLET

No. 11. Foot Rot in Sheep (*Revised*)

FIXED EQUIPMENT ON THE FARM LEAFLET

No. 5. The Milking Parlour (*Revised*) 1*s.* (1*s.* 2*d.* by post)

FREE ISSUES

Obtainable only from the Ministry (Publications), Soho Square, London, W.1.

UNNUMBERED LEAFLET

Farm Machinery Syndicates (*New*)

In Brief

COCKLESHELL GRIT FOR POULTRY

A new industry has recently been developed in the Western Isles—the production of shell grit for poultry from the famous "Cockle Strand" on the shores of the Island of Barra. This home-produced calcium supplement should appeal to poultry producers whose birds require considerable quantities of calcium to sustain egg shell formation.

The cockleshell grit produced in Barra is an attractive product containing about 98 per cent pure calcium carbonate. It is very suitable for poultry feeding as a supplement for egg shell formation and, since the need for calcium depends on the variable rate of lay of the individual bird, it is usual to provide a "free choice" supply of calcium supplement in the form of grit.

Obviously, for this purpose, attractiveness and palatability are very important, and observations at Auchincruive have shown that cockleshells are very palatable to laying birds.

In comparison with oyster shell grit, cockleshell grit is whiter, cleaner and has less dust. On chemical analysis, the cockleshell proved to have a slightly higher calcium carbonate content. It was also found to be harder and in solution in acid left a smaller insoluble residue.

Since the active ingredient of these grits is the calcium content, comparison between one product and another should be made on price related to percentage of calcium after taking account of palatability. The palatability of cockleshell and its home origin should commend it to poultry producers as a calcium supplement.

CIRCULAR SAWS

Some of the provisions of the Agriculture (Circular Saws) Regulations, 1959, came into force on 12th September. From that date an inexperienced agricultural worker must be instructed in the use of a circular saw, workers between 16 and 18 years old must be effectively supervised, and no worker under the age of 16 may operate or assist at a circular saw. The use of certain defective blades are banned and other precautions must be taken. A free explanatory leaflet is obtainable from the Ministry of Agriculture (Publications), Soho Square, London, W.1, or in Scotland, from the Department of Agriculture for Scotland, Broomhouse Drive, Edinburgh 11.

BROILERS AND DISEASE RISK

Dr. R. F. Gordon, Director of the Houghton Poultry Research Station, in his address to the Veterinary Association Congress at Folkestone recently, emphasized that a closer watch would have to be kept on the disease picture in the broiler industry. There was every indication from the course of events in other countries, he said, that the rapid passage of stock through broiler plants, particularly if associated with an increase in population density, would play an important role in the build-up of infection and subsequent increase in the incidence of avian diseases.

The broiler industry in this country was a very recent development and the majority of housing and equipment had been in use for only a comparatively short time. In many ways the industry has outstripped the knowledge necessary to preserve it. There were a number of conditions such as the one known as haemorrhagic disease which were approaching coccidiosis as a major cause of mortality where the initiating factors were unknown. With other diseases, however, the causes were known but they lacked the information as to the exact

way in which they spread under the peculiar and crowded conditions of broiler houses.

Above all, said Dr. Gordon, there was a pressing need for new knowledge defining the environmental requirements of the broiler chick.

A number of the diseases known to be present in the broiler areas of the U.S.A. were now occurring in our own flocks. These included epidemic tremors (which had rapidly increased in severity since the spring of 1957), arthritis caused by a variant strain of Salmonella, infectious synovitis (which was already widespread in America), parasitic diseases, and a wide range of respiratory diseases. Also of interest was the fact that fowl paralysis was occurring at an increasingly early age, while in some broiler flocks it was reaching epidemic proportions.

Scottish Farmer

HORTICULTURAL MARKETING

The Horticultural Marketing Advisory Council which was appointed in July 1958 has made its first annual report. Its terms of reference were "to consider and advise on plans for an independent Horticultural Marketing Council: to consider and advise on the work of the Ministry on the marketing and distribution of vegetables, fruit and flowers in England and Wales, and on desirable lines of development; and to report annually."

The report covers work by Committees of the Advisory Council on damage to produce in transit, the wholesale markets, and market intelligence. It contains a number of useful comments and suggestions, and is of particular interest in indicating the scope of activities which a permanent body might undertake for the whole horticultural industry. The following is a summary of some of the salient points.

The report says that damage which renders unsaleable one-tenth of 1 per cent of all produce handled in a year would cost the industry some £250,000. In point of fact, the extent of damage suffered in transit is very much greater than this.

The need for continuing activity is recommended, on the one hand to keep before the minds of all the need for care in handling, and on the other to encourage and promote better facilities and handling methods.

Frustrating delays in and around the wholesale markets are causing serious inefficiency of operation and add to the costs of marketing and distribution. Work studies are needed to spotlight particular deficiencies and suggest how they might be rectified.

Local authorities contemplating re-siting or rebuilding markets are anxious to have a central, well-informed body to which to look for advice, just as those in the industry want such a body to examine and act on suggestions for improving markets and marketing.

The horticultural market intelligence work of the Ministry is reviewed. The Advisory Council expresses the opinion that, in view of resources available, the Ministry's information service cannot easily be improved. A number of suggestions are, however, made with the object of increasing its usefulness to the industry.

Copies of this report are obtainable from the Ministry's Horticulture Division, Room 620, Whitehall Place (West Block), London, S.W.1.

A WIDER SEARCH FOR FOOD PLANTS

The ever-increasing problem of world food supplies and world population was the theme of Dr. G. Neil Jenkins's address to the Town and Country Planning summer school at Southampton. Dr. Jenkins is a lecturer at Durham University. He said that of several hundred thousand species of plants, less than a hundred were being used on any appreciable scale as a source of food. Moreover, out of

two million species of animals throughout the world only fifty or so were making any significant contribution to mankind's food. The circumstances of primitive man in his experimental choice of plant and animal life for food are no longer valid and "for all we know", Dr. Jenkins said, "the vitamins and proteins contained in wild plants growing in jungles may exceed those of the accepted foods".

Dr. Jenkins also pointed to the possibilities of fish farming in inland waters, which is capable of producing more protein than any other kind of livestock operation.

He thought that a world-wide survey of the nutritive possibilities of plants at present ignored as sources of food, should be undertaken, but conceded that the main obstacle to this approach is human conservation. "People tend not to like, or even refuse to try, the unfamiliar," said Dr. Jenkins. "But some new foods have been quickly adopted and have had revolutionary effects on agriculture and food habits, the potato being the classical example. It was introduced from the New World in the time of Elizabeth I and rapidly became a staple crop in Europe—with disastrous effects in Ireland in the 1840s. Within living memory tomatoes and bananas have become popular in this country and, if not of great nutritive importance, they have added flavour, variety and colour to our tables."

LIVER FLUKE: PRECAUTIONS FOR AUTUMN AND WINTER

The dry summer this year has greatly restricted the development of the liver fluke, so that, in marked contrast to last year, prospects for 1959 are good. Wet weather during the autumn is unlikely to have an adverse influence on this favourable situation.

In addition to any routine dosing of sheep which is undertaken, farmers who suffered losses from the disease last year are urged to dose all ewes which were at risk last winter and spring and which have not been treated since lambing time. Many of these ewes continued to be infected up to and after lambing, and this infection still remains in them. They should, therefore, be treated without delay in order to rid them of this infection. Replacement ewes bought during the autumn, whose history is not known, should also be dosed either with carbon tetrachloride or hexachloroethane. Similarly, cattle at risk last winter and spring will also benefit from a treatment with hexachloroethane.

Although the incidence of black disease is expected to be low this year, ewes on farms where the disease has occurred should be vaccinated during the autumn, in order to prevent any recurrence of the disease, which may arise even under conditions of very low fluke infestation.

CHANGE IN METHOD OF COMPENSATION FOR T.B. REACTORS

As from 1st October, 1959, compensation for Bovine T.B. reactors will be paid at a rate of 75 per cent of the market value of a comparable attested animal. At present compensation is based on a reactor's market value as an untested animal. This change has been made because the present method of assessment is out of date now that most of the country has been declared Eradication or Attested Areas.

It is calculated that the new basis of compensation will not affect the overall return to the owners of reactors. The change is essentially one of definition to meet the developing situation. As hitherto, the £100 maximum compensation payment remains unaltered.

At 30th June, 90 per cent of all the cattle in Great Britain were attested. In Scotland the figure was 99 per cent, and for Wales 98 per cent.

On 1st October another large part of the country, comprising the remainder of Scotland and of Wales and all the present eradication areas in England, became Attested Areas.

Book Reviews

An Hour-glass on the Run. ALLAN JOBSON. Michael Joseph. 18*s*.

The manner of life in the Suffolk village of Middleton-cum-Fordley which Mr. Jobson describes so agreeably from his own memories and those of his parents and grandparents is, at most, little more than a century away from us. But it was very different from anything we know today. For this was still the countryside of Old England, where the peasant tradition lingered, where things were made one at a time and by hand, where toothache was cured with elder twigs and asthma with charms, where the visit of "a hairy man with a mangy bear" was a major village sensation, and where men took for granted physical fatigue of an enduring intensity which we have forgotten.

This was the countryside which Crabbe, Tusser and even the Pastons would have found familiar. Yet so rapid are the changes wrought by the age of technology that it has now gone down into history, leaving only a few survivals to intrigue the visitor and delight the scholar. *An Hour-glass on the Run* will be one of the last books to describe it from personal and family recollection.

The village of Mr. Jobson's memories was a highly self-contained community. It bred its own power; built its own houses and farmsteads from local timber, flint and clay; ground its corn at its own mill; brewed its own beers and wines; manufactured its starch from potatoes and its lights from fat, rushes and hand-made wicks; raised its own "companies" for work and play. Socially, it was highly clannish, as befits a village in an area where that decisive phrase "the Shires" covers all those parts of England that have the misfortune to lie outside the borders of Norfolk and Suffolk.

In such a limited, close-knit community, the old ways died hard and the author's grandfather had even heard by tradition of the Need Fire when, in the times of cattle-plague, all the house fires in the village were extinguished and the cattle were passed through the smoke of a new fire kindled by rubbing together two pieces of wood. Most of these survivals have now perished; but only a dozen years ago, a few miles from the author's village, I met a case of sympathetic magic and heard a farmer casually mention that when young he had consulted a local "white wizard" about a lost watch.

This is a good book and its photographs of the countrymen of late Victorian times are a delight. But it is not a complete guide to the past. Time has softened the memories of old injustices and hardships described so honestly and indignantly by men like Haggard, Arch and Henslow, while historical sense has failed to grasp the vestigial importance of the village bricklayers, carpenters, blacksmiths and shoemakers, the heirs of Lister the dyer, Kett the tanner and the other rural craftsmen who were once the natural leaders of the village community. So Mr. Jobson may unwittingly encourage urban readers in their spurious golden dream of a merry England wherein all men lived by farming. But he has preserved much that should be preserved, and gives great pleasure in so doing.

N.H.

Trees of Britain. ROBERT GURNEY. Faber and Faber. 30*s*.

No matter how many "tree books" appear, there is always something fresh to be discovered about our forest flora, and Dr. Gurney has developed a charming way of presenting unfamiliar facts. His standpoint is that of the inquiring botanist, and the extensive list of references shows how thoroughly he has searched through recent English and Continental literature to glean the latest facts. The author's intimate knowledge of the living tree is apparent from his splendid series of sketches, involving some 600 separate drawings of the fine details of over eighty common trees. In particular he has sought out and depicted the seedlings of most of these—so filling a considerable gap in our records of forest botany. Only a selection of trees are illustrated as

growing specimens, but the eighteen photographs chosen are of a high pictorial standard.

I would emphasize, however, that this is hardly a text-book for the forester. The treatment of coniferous trees is sketchy, and even such familiar kinds as the lodgepole pine and the western hemlock—now planted by the million for their timber—are scarcely mentioned. Dr. Gurney is little concerned with the craft of raising trees, whether it be for timber, ornament, or shelter on the farm; he gives brief accounts of timber uses, but omits to mention any for beech, our most readily marketable hardwood. It is hard to follow the author's contention that, by preventing regeneration, rabbits destroyed the *prehistoric* beechwoods, since it is generally agreed that rabbits were unknown in Britain until the Normans introduced them for sport, some time after 1066 A.D. He seems to have forgotten that, even in Neolithic times, there were farmers busy clearing the South Downs's beechwoods to get cornland, while their sheep ate the seedling trees. The photograph labelled "beech leaves" depicts wych elm leaves and fruits—an unfortunate error, since both trees are accurately illustrated elsewhere. It is surprising to read that elder is not native to Scotland—where in fact it bears the old Scots name of "bore-tree" and the even older Gaelic one of *truim*.

These, however, are minor slips amid a wealth of learning. Those who want a readable guide to the common broad-leaved trees of woodland and hedgerow will find this book an excellent investment. It is particularly helpful over those notoriously difficult groups, the willows, elms, and whitebeams, each clarified by ample sketches.

H.L.E.

The Story of Cheese-making in Britain. VAL CHEKE. Routledge and Kegan Paul. 40s.

The late Henry Ford is said to have remarked in a Chicago witness-box that "history is bunk". It is probable, however, that he knew nothing whatever of the history of agriculture or dairying, which can be so intriguing to study and is at last beginning to receive the attention it deserves. With her very attractive story of cheese-making, Miss Cheke has filled a large gap in British agricultural literature, and it is likely that her book will long remain an important source of information and, for the most part, a classic of its type. Its preparation must have involved years of devoted and patient research work, and in presenting her story the author has recorded much not only about cheese and its making, but also about the lives and living conditions of those who made it.

Apart from the appendix, the book is written for the expert and the intelligent layman, and it should be read by both with equal pleasure and enthusiasm. The first two chapters discuss the nature of milk and the principles of cheese-making and storage. The third chapter deals with very early history, and includes reference to cheese-making during the Roman occupation and to the early methods of making rennet. Subsequent chapters describe conditions in Saxon and Tudor times and in the seventeenth, eighteenth and nineteenth centuries.

One gathers that Miss Cheke would not like to have been a dairymaid in those early days and that the men folk had the best of it, which all goes to show how times have changed! Towards the end of the book there are informative chapters on the making and judging of cheese after 1900, and on present-day methods of cheese-making and grading. An account is given also of how modern cheeses have evolved.

The text is well illustrated, with nineteen figures and forty-five plates, all attractively reproduced, and the volume ends with a most helpful glossary of ancient and modern words, a bibliography and a good index.

The part of the book that is likely to be criticized most is the appendix, which makes up 38 of the 347 pages. As in man himself, it is not clear why the appendix is there, and much could be said for its removal! It claims "to demonstrate the vital importance of microbiological action in the field of dairy technology", but it is too scientific for the reasonably informed layman and not scientific enough for the scientist. One or two passages are not in complete accord with recently acquired knowledge, and several parts have only the remotest connection with the story of cheese-making which is, after all, what the book is about.

In its present form (apart from the appendix) the book deserves to have a wide public and to run into many editions.

J.A.B.S.

Farm Organization and Management. G. G. HAYES. Crosby Lockwood. 25*s*.

Mr. Hayes is to be complimented on the forthright attempt he makes in the opening pages of his book to clear up the vagueness which too often surrounds the terms "farm management" and "farm organization". Practice has for so long used the former when the latter is meant that to insist on the use of the correct term in each situation nowadays would probably only add to the confusion. Nevertheless, Mr. Hayes does a good service in differentiating between the two so clearly.

Unfortunately the same clarity does not persist throughout the book. For instance, not everyone would agree that all the subjects Mr. Hayes includes, such as agricultural marketing (in chapter 5) and agricultural prices (in chapter 6), come within the definition of farm organization and management. If those sections of Parts I and II which more properly belong to the wider aspects of agricultural economics had been excluded, more attention could have been paid to planning, including linear and programme planning—two techniques which are surely already sufficiently well established to deserve mention.

It is strange, too, to see agricultural marketing confined to those products which come under a marketing board, while livestock marketing is discussed under agricultural prices. Under the heading "Economic Considerations", the principle of the law of diminishing returns is explained at some length, but there is no attempt to link it to the very brief reference which is made to the relative advantages of extensive and intensive farming. Nor is the advantage which follows from the integration of enterprises put forward in favour of mixed compared with specialized farming.

The equally important distinction between fixed and variable costs is completely ignored, and this may help to explain the very unusual method of treating labour in the example given of partial planning (or budgeting). More attention to fixed and variable costs would also have prevented the conclusion that, but for the law of diminishing returns, a twelvefold increase in the amount of food fed to cows would result in a twelvefold increase in the profits of milk production.

Against the confusion which these parts of the book engender has to be set the very easy style in which it is written. It is refreshingly free from jargon, and should help the public at which it is aimed—students and practising farmers—to understand the significance of organization and management in farming.

W.H.L.

Forest Machinery. E. R. HUGGARD and T. H. OWEN. A. and C. Black. 24*s*.

The past twenty years have seen the steady development of a great variety of machinery for work in the forest or forest nursery, and among hedgerow or park trees. Machines are used for ground cultivation, transplanting young trees, spraying them to check pests and diseases, and for pumping water during fire fighting. Power saws are widely used for tree felling, and in the sphere of timber-hauling the tractor has now ousted the horse for all but the smallest of poles. Portable machinery for stripping off bark, and even mobile sawmills that one can move round the forest or the farm, are now coming into general use. Road-making in the forest has been almost entirely mechanized.

Everyone concerned with trees now needs to have a very wide knowledge of machinery. Although even a big estate may own little equipment, the forester must be able to say what machines can profitably be hired from contractors, or used by timber merchants to handle a particular parcel of timber. However, many implements can be operated by an ordinary tractor or its power take-off, so that the purchase of such an item as a small cross-cut saw bench is a reasonable investment on any farm with a fair acreage of woodland.

Hitherto there has been no ready guide to what is available, or how it can be used. The only way of learning was to write to scores of separate manufacturers, or wander round occasional exhibitions. Now a forest engineer and a silviculturist, both engaged on the teaching of forestry in the University College of North Wales at Bangor, have combined to produce a really practical guide to the possibilities and limitations of forest machinery currently available in Britain. Obviously they have had the co-operation of the manufacturing firms in providing such a wealth of illustrations at so modest a price. Equally obviously everything illustrated is proprietary, but that is inevitable, since few foresters are ever going to build their own machines. Each picture serves to re-

present its particular *type* of machine, and it is up to the user to select the right *make* of that type to fit his own particular job.

Everyone who proposes to buy a forestry machine, or even to hire one for a few days, would be well advised to buy this book first; and it will be indispensable to forestry students.

H.L.E.

The Lily Year Book 1959. Royal Horticultural Society. 10*s*.

The Royal Horticultural Society's Year Books are well known for their standard of excellence and this is well maintained by the 22nd volume of the *Lily Year Book*. The editorial committee are to be congratulated on the production of an interesting and well-balanced number. The reports on the symposia on feeding lilies, handling seedlings and fritillaries in the open, the Lily Group's discussions on vegetative propagation and growing lilies in pots are most useful and helpful in this respect.

The volume is dedicated to Miss Christabel Beck and it is fitting that the genus fritillaria receives attention from Dr. Turrill in one of the symposia reported. Gardeners are greatly indebted to Miss Beck for her interest and work on fritillaries.

Lily collections receive attention from E. E. Kemp and A. Evans in respect of those at Edinburgh, Sir Frederick Stern at Highdown, W. G. Knox Findlay at Keillour, H. Cocker at Villa Taranto and Col. J. Leslie at Brancaster. The lily is of increasing interest for exhibition, and Edgar L. Cline contributes a most useful article on their preparation and care for this purpose.

There are few errors or matters for criticism in the volume, but it would be helpful if contributors did not use proprietary names for disease control materials. It would be better to quote the active material and, where applicable, refer to the product group in the Ministry's Official Approval Scheme. "Folosan", which is a TCNB preparation formulated as a dust, is described as a spray. The paragraph on protective dusts on p. 80 is most confusing. "Arasan" should read "Aretan" and is a mercurial dip for the control of skin-borne diseases. "Premosan" should read "Premasan" and is a thiram-based seed dressing. The active material in "Grisovin" is the antibiotic griseofulvin and not TTMDS. The latter should read TMTDS and refers to "Premasan" in the previous sentence, not to "Grisovin".

In 1958 the Royal Horticultural Society was appointed as the International Registration Authority for lily names; this, together with the proposal to hold a third Lily Conference in London in July 1959, makes the present volume a most acceptable introduction to a year of great importance for those interested in the lily.

G.F.S.

Farm Mechanization Management. C. Culpin. Crosby Lockwood. 21*s*.

The economic aspects of the application of power and machinery to agriculture are of vital concern to the farmer of today. Mr. Culpin's practical approach to the subject is widely known through his previous work, *Farm Mechanization*; but his new book serves a most useful purpose in selecting from and summarizing new evidence of the value of mechanization to farming. Emphasis is placed upon the economic suitability of a number of modern machines for the problems arising during a farming year. Examples and tables illustrate how costing methods can be applied in practice, and how depreciation and repair costs can be related to variations in annual use.

The chapter on "Work Study and Mechanization" is particularly interesting. The author points out the differences of opinion about how work study may best be applied, and the different construction put upon the expression in the U.S.A., where the emphasis in agriculture is on work simplification, rather than the employment of professional consultants. The exposition of the "method study" approach should be most helpful to farmers.

Other chapters deal with the use of efficiency standards in mechanization and management; the mechanization of crop production; harvesting and conserving green fodder, corn, seed, pea and root crops. There is also a section dealing with the increasing trend to mechanize livestock tending.

Farm Mechanization Management is very well illustrated, and contains an appendix of statistical material which should prove most valuable. The cost and profitability of mechanization are of first importance to farmers. This book will help them more easily to assess both.

R.E.S.

Mink Farming (3rd Edition). R. B. SERJEANT. Landsman's Bookshop. 10*s*.

Originally produced in 1949, this book is based almost entirely on the experiences of the author, who has made mink farming pay in this country. Because of this it must command respect for its many practical hints and tips, though Mr. Serjeant would not claim that other techniques could not be applied successfully. In many respects, this edition has been appreciably brought up to date, and entirely new chapters have been added on "The Humane Killing of Mink" (written by Dr. Jean Vinter, the Technical Secretary of the University Federation for Animal Welfare) and "The Fur Breeders' Association of the United Kingdom".

Mink Farming is a practical man's effort, and if criticism in the adverse sense has to be applied it must be directed to two particular aspects. The chapter on mutations and mutation breeding is too brief: these are two of the main facets upon which the mink-farming industry can rely for its survival and permanent success. On account of the extensive gene pool available and the comparative ease of producing the desired mutation in a few generations, they deserved fuller treatment. By far the weakest chapter is that on diseases. It contains regrettable inaccuracies, such as that nutritional anaemia is due to lack of vitamin B (as if that was a single entity and not a complex group, all the members of which have not yet been isolated), and the mis-spelling of trade names in the field of antibiotics. The chapter, "Specimen Expense Accounts", which was in the second edition, has been omitted and there are no indications of what prices a newcomer to the industry may expect to pay.

The book is well produced and, being in stiff covers, is easier to keep than the earlier pamphlet editions.

W.M.A.

Dairy Produce, 1958. Commonwealth Economic Committee. H.M. Stationery Office. 5*s*. (5*s*. 9*d*. by post).

In its Commodity Series the Commonwealth Economic Committee annually publishes a review of the significant trends in world production, consumption, trade and prices of dairy produce; including in its scope butter, cheese, condensed milk, milk powder, casein, eggs, egg products and margarine. The most recent edition contains quantitative statistics up to the end of 1957, while some of the prices quoted extend into 1958. In essence the review is a collection of statistics presented in tables which give comparisons between the figures for pre-war—usually taken as 1938—and the years 1953 to 1957, and embraces production, imports, exports, consumption per head, utilization and prices. All countries for which any significant figures are available are included in these tables, which relate to world trade. The discussion makes interesting reading, presenting, as it does, the general conclusions to be drawn from the figures, and high-lighting any special features.

It is perhaps understandable, in view of the organization which is responsible for publishing the review, that it should seek, both in tables and text, to emphasize the Commonwealth aspect. However, it may be doubted whether the Commonwealth, as such, should be represented so frequently as an economic entity: many of the countries within the Commonwealth have in fact no significance as producers of, or indeed as traders in, dairy products. Those which have significance are appropriately referred to as "Commonwealth countries", and the reader is in no doubt which are meant.

For those to whom the survey, after being once read, is a work of reference, it would be helpful if an index of tables were included.

The two appendices which occupy the last forty pages present an interesting survey of the measures taken by the governments of ten countries, by one means or another, to give support to their dairy industries. This reflects the high importance attached to the industry, and it is noteworthy that all the countries are in Europe, North America, or the southern dominions.

K.H.B.

Annual and Biennial Flowers. A. P. BALFOUR. Penguin Books. 6*s*.

Mr. A. P. Balfour is one of our leading authorities on annuals and biennials, and in collaboration with the Royal Horticultural Society he has produced a most interesting and stimulating little book. It is quite remarkable how much information

concerning these flowers he has managed to pack into its 261 pages. In many books written mainly for the amateur, there is a careless disregard for accuracy, but not so this one. It is sufficiently accurate and up-to-date to be used not only by keen amateurs, but by serious students of horticulture and professional horticulturists.

As stated in the introduction, the object of the book is to present a picture of the place of annual and biennial flowering plants in present-day horticulture. It does this with the aid of nearly 250 plates, which include some first-rate how-to-do-it pictures of such operations as seed sowing, pricking off, thinning out and transplanting. Most of the well-known annuals and biennials are illustrated, and there are detailed descriptions of twenty-five of the best known. There is a chapter devoted to plants suitable for growing in pots for the cool greenhouse, and another which gives an interesting account of how new garden varieties have arisen.

Naturally, some plants are dealt with in greater detail than others, and it is pleasing to note that nearly four pages are devoted to stocks, including a description of the Hansen double strains. I was pleased also to see a reference to the Excelsior strain of foxgloves, and the note that foxgloves can be easily transplanted, even when in full bloom, without the aid apparently of plastic solutions. Throughout the book many useful tips are given; for example, that *Verbena rigida*, which most of us know as venosa, does well near the sea (in Devon it over-winters), and that the large-flowered nemesias make excellent cut flowers, lasting in water sometimes as long as 2–3 weeks.

At 6*s*. this book is remarkably good value.

W.C.I.

The Economics of Potato Storage. G. B. Bisset, E. Dawson and R. Bennett Jones. Universities of Reading, Leeds and Nottingham. 5*s*.

This is an interesting and timely report resulting from a substantial survey of the chief potato growing districts. One hundred and thirty-two farmers, growing nearly 3,000 acres of maincrop potatoes, have co-operated in the study.

The conclusions are of the utmost practical importance to the farmer who is contemplating the provision of a potato store. Purely from the financial standpoint, it appears that there is little to choose between storing potatoes indoors or in clamps. The authors calculate that the saving in cost may be some 8*s*. a ton. Against this must be set the cost of new storage buildings, from £5 to £6 a ton, carrying an annual charge of approximately 9*s*. But if the use of adapted buildings enables a farmer to provide storage for 5*s*. or less a ton, indoor storage may be advantageous.

The section dealing with "returns" is of less lasting value since in the year of the study, 1956–57, potato production was unusually high. However, since some farmers instal stores in the hopes of extra returns, it is worth recording that the average price realized was 4*s*. a ton lower than for potatoes stored in clamps.

In the discussion of the physical aspects, the careful reader may come across certain inconsistencies. It would be interesting to have some finite assessment of damage to potatoes in store, both in clamps and buildings, whilst the assumption that the loss in weight from indoor storage equals the loss caused by disease on clamp sites is "not proven".

S.E.L.

Systematic Stock Judging Instruction. D. C. Bower. National Federation of Young Farmers' Clubs. 1*s*. 3*d*.

In this booklet the author recommends a system of training consisting of six stages, with three exercises for developing the skill attained during instruction.

A points system of assessing and comparing animals is used in the first four stages, during which correct handling, observation and a sequence of inspection are instilled into the pupil. The two last stages are intended to condense into more general terms the detail learnt in earlier training, at the same time developing the ability to compare animals rather than describe them. Attention is given to the preparation of concise notes and the presentation of the statement of reasons for placing.

The publication is to be commended in that the methods suggested should produce a systematic improvement in the attributes essential to a sound judge of stock. Although intended primarily for trainers, it will prove useful also to pupils and competition judges.

G.A.M.

Apple Production: A Grower's Guide to Costs and Returns. (University of Cambridge, School of Agriculture, Farm Economics Branch, Mimeographed Report No. 56.) D. B. WALLACE and A. J. PLAISTER. 2*s*. 6*d*.

"The object of this short study of the cost of growing apples in the Eastern Counties is to provide growers who have not the time or staff to carry out detailed costings with a simple means of discovering whether their orchards are likely to be profitable or not at different levels of prices and yields." So reads the first part of the foreword to this study.

Armed with these terms of reference, the authors assess the implications of the large-scale plantings of dessert apples since 1945. They then produce a synthesized model of the costs of production based on a local survey, supplemented by material published by colleagues in other areas, and finally use the figures to produce price/yield relationships for dessert and culinary varieties.

The period 1945–51 saw a large increase in plantings of dessert varieties—particularly Cox's Orange Pippin. During the same period there was a large drop in the acreage of culinary varieties, with Bramley's Seedling falling less sharply than most.

From work at Wye, the authors assume that the plantings which took place between 1945 and 1949 are now "self supporting" and will be increasing in productivity, reaching a peak by about 1965. The question of imports and likely consumer reaction are considered, and it is felt that there is no direct evidence to suggest that a rising standard of living might necessarily result in a greater consumption of apples.

The general conclusion reached is that the sale of Cox's could be expanded by about 50 per cent at present prices, but only if "level grading and better presentation" are achieved. Further, it is suggested that the outlook for other dessert and all cooking varieties is "not a happy one in so far as fresh fruit is concerned unless a radical change takes place in the nation's taste". The view is expressed that a manufacturing outlet for processed apples may become necessary to cope with the falling market—a rather gloomy view, but one which must be considered seriously.

To enable growers to obtain an idea of total fixed and variable costs of production, storage, grading, packing, etc., a straightforward system of accounting is given for the East Anglian orchards used in the survey. These orchards cover a wide range of conditions, and this point has been considered in arriving at the figures quoted.

Synthesized model costs obtained from the survey are utilized to show two sets of curves from which a grower can estimate the likely price/yield relationship necessary to cover direct costs, and provide a surplus of £70 per acre over those costs. This figure is suggested as sufficient to cover management, marketing and general overall costs, and leave a profit. An interesting table is given showing the number of bushels per acre of dessert and culinary varieties needed to "break even" and give a £70 per acre surplus at given market prices.

B.D.A.T.

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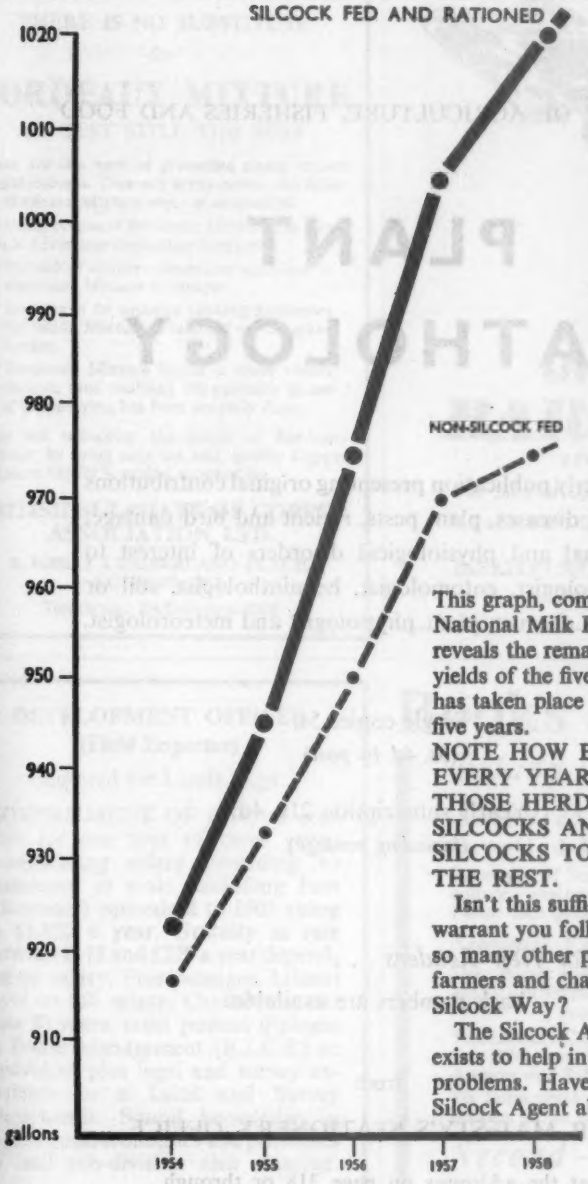

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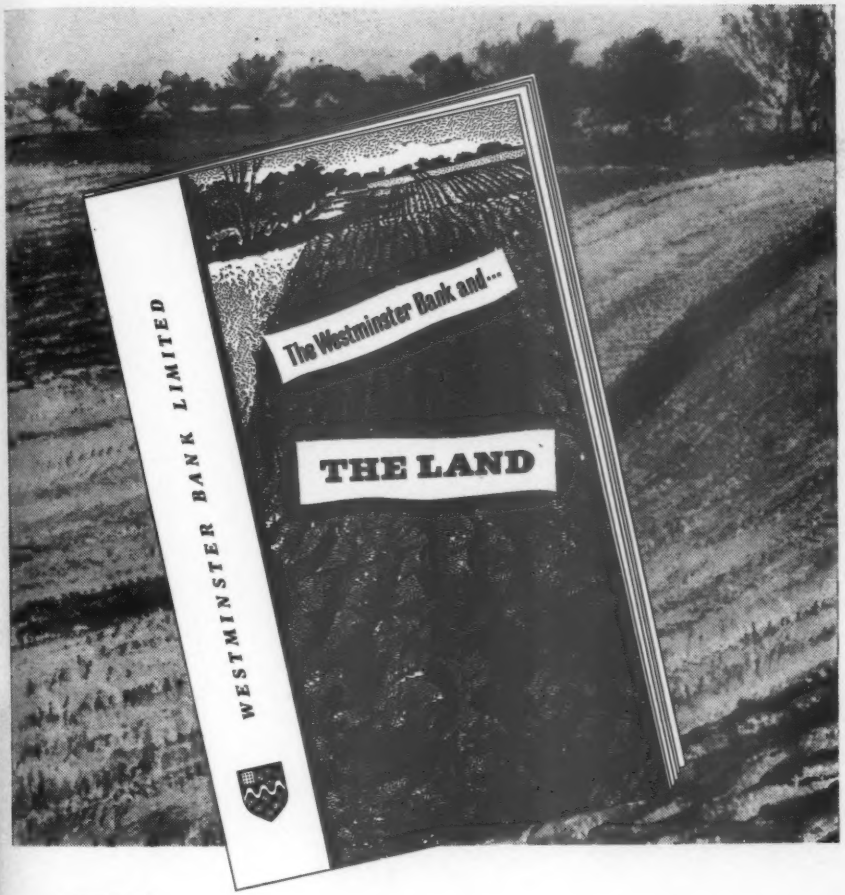

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